DOMESTIC ENGINEERING

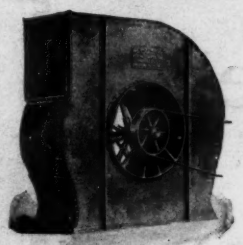
Whole Number 135 *Chicago and New York, January Fifteenth, Nineteen Hundred and One* *Vol. 20, No. 4*

PENN RADIATOR COMPANY, CORRY, PA. INDIRECT—DIRECT DIRECT INDIRECT RADIATORS

NEW YORK, BOSTON, MINNEAPOLIS, DENVER, PHILADELPHIA, ST. LOUIS, LONDON, HAMBURG **AMERICAN RADIATOR CO.** GENERAL OFFICES LAKE & DEARBORN STS. CHICAGO.

DON'T SWEAR
USE OUR INCANDESCENT MANTELS IN 1901
Harding Incandescent Co.
HARDING BLDG.
CHICAGO.

BUFFALO FAN SYSTEM



OF HEATING VENTILATING AND DRYING

BUFFALO FORGE COMPANY
BUFFALO, N. Y.

F. E. Cudell's PATENT sewer gas and back-water trap

for wash bowls, sinks, bath and wash tubs

Put into the White House by the U. S. government. For venting use vent trap.

CLEVELAND, OHIO

PATTERNS
GOBEILLE PATTERN CO. Cleveland, O.

MANTLE CHEMICALS
The Roessler & Hasslacher Chemical Co.
Office: 100 William St., New York
Chicago Office: 16 N. Clark St.

See our Advertisement...Page 57

WHAT A DIFFERENCE
In the quality of Plumbing work.
RAYMOND'S

COMBINATION FERRULES MAKE RELIABLE CONNECTIONS BETWEEN LEAD AND IRON PIPES.

WHY?

Because they have an extra thickness of lead over the shoulder, giving strength where it is needed, and where other Lead Ferrules are weak.

The genuine article bears our label.

RAYMOND LEAD COMPANY, CHICAGO.

UNIONTOWN ACME RADIATOR CO.
UNIONTOWN, PA.
MANUFACTURERS OF
STEAM AND HOT WATER RADIATORS

—JENKINS' '96 PACKING—
Pronounced by steam users throughout the world the best joint packing manufactured. Expensive? Not at all, as it weighs 30 per cent less than many other packings, consequently is much cheaper.
JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

IN PROFESSIONAL SUCCESS
practice is an important factor, but it is an even more important factor in successful artificial lighting. My practice covers forty years and I have had opportunity to learn something about lighting.
I. P. FRINK, 551 Pearl St., N. Y. City

WATER LIFTS — BIG SUPPLY VOLUME — L. E. RHODES CO. HARTFORD, CT.

LAWLER'S MODERN PLUMBING
MOST PRACTICAL BOOK EVER WRITTEN. PRICE $5.00
DOMESTIC ENGINEERING, CHICAGO, ILL.

The Pattern Shop of the East
H. B. OLMSTEAD & CO.
87 FRANKFORT ST NEW YORK

SEE ADV. ON PAGE FOUR
Paragon Boiler
ISAAC A. SHEPPARD & CO., - PHILADELPHIA

STOVE PIPE WATER HEATER $15.00 FURNACE HELPER $25.00
THE STOVE PIPE WATER HEATER goes in any stove pipe and with the waste heat warms water for tank, bath, kitchen, stock or laundry, or with radiator an extra room. THE FURNACE HELPER goes in smoke pipe of furnace, steam or hot water boiler and will warm rooms furnace cannot. It furnishes hot water from the heat which goes up the chimney. Sent on two weeks trial. Our REGURGITATING SAFETY VALVE, $10., can be attached to any hot water plant, old or new. It prevents boiling over, makes radiators do a half more work. If you are in trouble send for one. Ask for booklet "How to Utilize Waste Heat" or send money with order. Agents Wanted.
ANDREWS HEATING COMPANY, 1208 GUARANTY BUILDING, MINNEAPOLIS, MINN., U. S. A.

PENN RADIATOR COMPANY, CORRY, PA. INDIRECT—DIRECT DIRECT INDIRECT RADIATORS

The Grand Prix

Highest Possible Award—higher than gold,
silver or bronze medals or honorable mention

and the ONLY Grand Prix Given

at the

Exposition Universelle
Paris, 1900

on Radiators and House Heating Boilers to any Heating Apparatus
Manufacturer in the World was awarded to

AMERICAN RADIATORS

AND

IDEAL BOILERS

MADE BY

AMERICAN RADIATOR COMPANY

Chicago Boston Philadelphia Minneapolis New York Buffalo St. Louis Denver

IN COMPETITION WITH THE ENTIRE WORLD.
THE ONLY
GOLD MEDAL
GIVEN AT THE
PARIS EXPOSITION, 1900
FOR EXHIBITS OF
VALVES AND FITTINGS
WAS AWARDED TO
CRANE CO.
NEW YORK
PHILADELPHIA
CINCINNATI
KANSAS CITY
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CHICAGO
ESTABLISHED 1855
ST. PAUL
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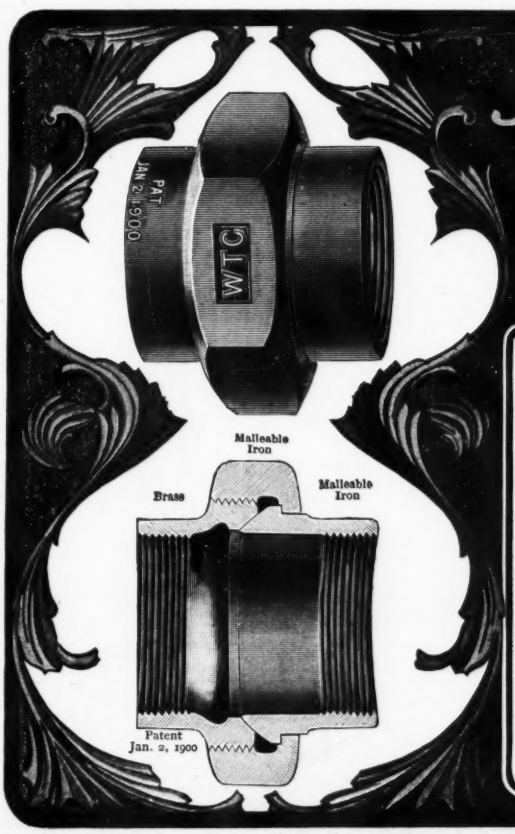
LOS ANGELES
SAN FRANCISCO
PORTLAND, ORE.
WRITE FOR POCKET CATALOGUE

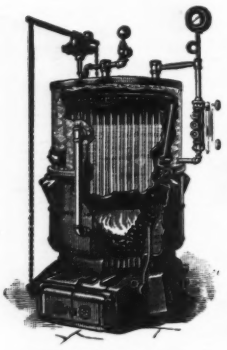


A UNION WITH NO GASKET
Will not Rust.

"The Kewanee"
It is removable

the joint being easily disconnected because of the different metals (brass and iron) employed. Write for circular.

MANUFACTURED BY
Western Tube Co.
Kewanee, Ill.



Hard Coal Boiler.

The Gorton Side Feed Boilers

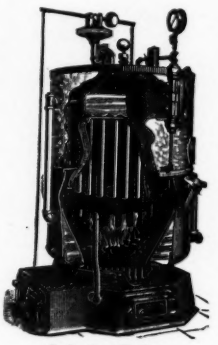
You want the best, We have it.

FOR STEAM AND HOT WATER HEATING.

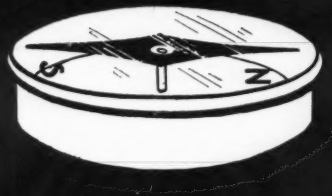
Send for Catalogue and Investigate for Yourself.

96 Liberty Street, New York.
77 Oliver Street, Boston, Mass.
Old Colony Bldg. Chicago.
Prudential Bldg. Atlanta, Ga.

GORTON & LIDGERWOOD CO.



Soft Coal Boiler.



THE COMPASS

which points invariably toward sure and lasting profits is the **Paragon Steam Generator.** If used rightly it will guide you to a bigger and better business than you have ever done before. Steer your business by the Paragon if you want to reach the most profitable harbor.

Paragon is also the name of the best Hot Air Furnace made.

ISAAC A. SHEPPARD & CO.,

NEW YORK, PHILADELPHIA, BALTIMORE.

Holland Radiators...

Chicago Office, 38 Dearborn Street.
Denver, Colo., Office, 1759 Stout Street.
Works, Bremen, Indiana.

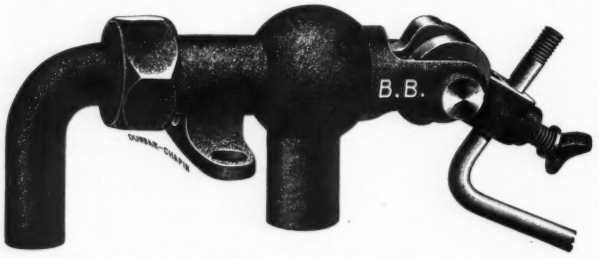
Kansas City, Mo., Agents, U. S. Water & Steam Supply Co.
Cleveland, Ohio, Agents, The George Worthington Co.

At above points a complete line of our Bremen--Reliance--Eclipse and Unique Radiators are carried.

Permit us to demonstrate how well we can serve you. . . .

HOLLAND RADIATOR COMPANY.

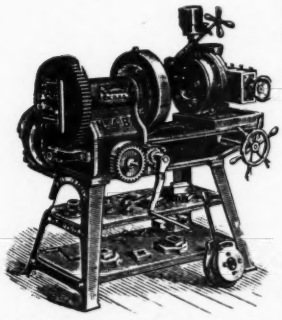
THE B. B. HIGH-PRESSURE BALL COCK



THE SIMPLEST AND BEST COCK EVER MADE.

No special packing required. Ground joint coupling which is always tight. Roller bearing lever on cam, reducing friction to lowest amount. No hammering, no singing or whistling. Has only one packing which is easily removed. Removable seat of best steam metal. We are making Floats stamped with our B. B. which are throughly guaranteed. Ask your jobbers for them.

Boston Brass Co., 36 & 40 Oliver St., Boston, Mass.



No. 4 B. Pipe Cutting and Threading Machine, ⅛ inch to 4 inches Hand or Power.

D. SAUNDERS' SONS,

Manufacturers of Patent.

HAND

PIPE

CUTTERS

IN THREE STYLES.

One Wheel and Roller Cutter; Three Wheeled Cutter; Tool Cutter,

FOR CUTTING BRASS, COPPER AND WROUGHT IRON TUBES.

Also Manufacturers of Pipe Cutting and Threading Machines 1-4 to 16 in., Hand or Power.

Send for Catalogue. 35 Atherton Street, YONKERS, N. Y.

Send Us Your Orders for

Lead Pipe
Sheet Lead
Solder
Lead Traps
Lead Bends
Combination Ferrules and Soldering Nipples
Bi-Metallic Traps, etc.

We guarantee lowest market prices

We guarantee prompt shipment

Sportsman's Shot Works, Cincinnati

Two Great Wrenches

The "TRIUMPH" and The "ALLIGATOR"

Never loses its grip or its handle.
Never crushes or locks on the pipe.
Can be used as a monkey-wrench or pipe-wrench.

The Original. Always ready.
The Reliable. Always positive.
The Genuine. Never slips.

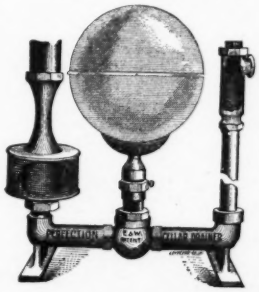
Write for circulars and prices and mention DOMESTIC ENGINEERING

American Saw Co.

TRENTON, N. J.

We Want You

When in the market for



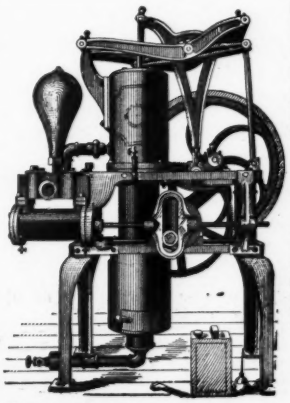
Hot Air Pumping Engines

Hydraulic Pumps

or

Cellar Drainers

to let us tell you about our devices and quote prices



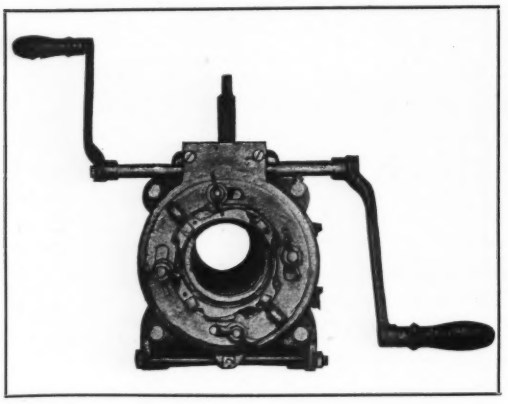
Erwin-Welch Hot Air Pumping Engine, Operated by use of gas, coal, gasoline or kerosene oil. Used to pump water from city mains to roof tanks or for pumping water from wells, cisterns, lakes and rivers for domestic or irrigation purposes.

Erwin-Welch Automatic Hydraulic Pump, Operated by Water Pressure Only. Used to increase city water pressure, or for pumping water from wells or cisterns for domestic use. These pumps can be used without wasting water and are automatic in their operation. Built in 25 sizes.

Our Perfection Cellar Drainer Is operated by water or steam pressure. Used to force out water that may accumulate in Cellars, Wheel Pits, Foundation, Ditch and Pit Excavations, etc. The Drainer stops and starts automatically. Is the strongest, most durable and most efficient made.

Descriptive Circulars Sent Upon Request

ERWIN & WELCH, Manufacturers, 35 and 37 S. Canal Street, CHICAGO



Combination Vise
and
Screw Cutting Machinery

SAVES TIME AND MONEY

SEND FOR CATALOG AND PRICES

HICKMAN-MELHORN CO.

200-208 Liberty Ave., PITTSBURG, PA.

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New York
The Law Company
123 Liberty Street

Baltimore
Cuyler & Mohler
2324-2326 Boston Street

The Policy of this Journal

WE believe success—long continued, permanent success—can only be achieved in the newspaper business by conducting it in the same way a man builds a good reputation—it must have character back of it, and character, a strong character, must be based on honest intention. We all slip up in fulfillments, but good intent is necessary if good fulfillment ever comes. Our intent is to print the best trade journal in the world, in the best way, seeking for the best result. It you think we are falling short of the mark, in the interest of good results, please let us know.

DOMESTIC ENGINEERING,
JNO. K. ALLEN, President.

OUR COMBINATION HAND AND POWER PIPE THREADING AND CUTTING MACHINE

Is the greatest pipe machine you ever saw. It is made in four sizes, to thread and cut off pipe 1 to 4 inches, 1 to 6 inches, 2⅛ to 8 inches, and 4 to 12 inches.

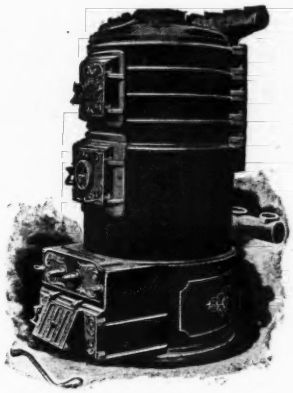
The vise is self-centering, actuated by rack and pinion to feed the pipe into the chasers. You furnish the power and the chasers do the rest.

This machine is mounted on a base for use either by hand or power at will. But if you want to take it out on a job it may be readily removed from its base and used as a portable hand machine.

We want you to know more about our line of pipe machines. Catalogue No. 3 tells, and its yours for the asking.

THE MERRELL MFG. CO. TOLEDO, O. U.S.A.

BURRELL & FOWLER CLEVD O



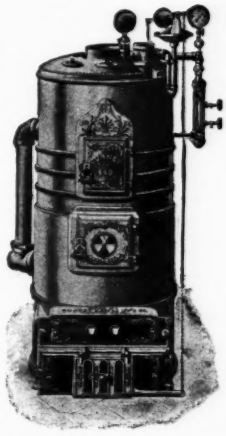
Gurney 400 Series Hot Water Heater.

Gurney

HOT WATER HEATERS
Steam Boilers
AND
RADIATORS

Represent **Progression** and **Advancement** in the Manufacture of Successful **Heating Apparatus.**

SOLD ONLY THROUGH THE TRADE.



Gurney 400 Series Steam Boiler.

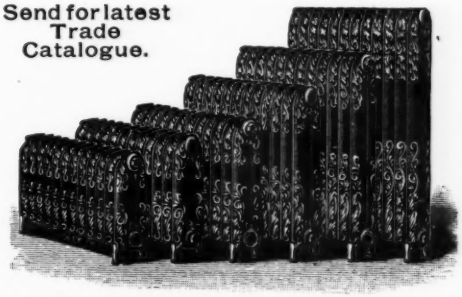
THE STANDARD OF THE WORLD for their Respective Requirements.

"Bright Idea" Steam Boiler, Sectional View.

For Durability, Efficiency and Economy, They Continue To Be Unsurpassed.

Send for latest Trade Catalogue.

Doric Hot Water Heater.



Duet Radiators for Hot Water and for Steam.

GURNEY HEATER MFG., CO.
74 Franklin St., Cor. Arch, BOSTON, MASS.
New York Branch: 111 Fifth Ave., cor. 18th St., N. Y.
Western Selling Agents: JAMES B. CLOW & SONS, 222-224 Lake St., Chicago.

Henderson Heaters

HAVE A SPECIAL DEVICE FOR

Burning the Gases

which commonly go unburned to the chimney. Without this device these heaters are equal to any made.

WITH IT THEY STAND ALONE.

The Prizer-Painter Stove and Heater Co.

READING, PA.

34 NORTH CANAL STREET
CHICAGO

284 AND 286 PEARL STREET
NEW YORK

PATENTED Dec. 9, 1890.
Feb. 2, 1892. June 14, 1892.
Other patents pending.

VACUUM VALVE No. 7

PERFECTED=DUPLEX

Steam Air Valve will automatically vent the radiator of the air, close by

FLOTATION AGAINST WATER and by **EXPANSION AGAINST STEAM**

After the air has been expelled from the radiator the **vacuum feature,** in the **top part of the valve,** is brought into service by the **phosphor bronze ball seating itself** so as not to permit any air to enter into the radiator through the valve, thus causing a vacuum, thereby necessarily **reducing consumption of fuel,** and with the valuable feature of locked shield which prevents tampering, must appeal to every user.

The **radiation surface** is **entirely heated,** which a steam heating **contractor will appreciate,** where contracts stipulate degree of temperature required.

PRICE, $2.00 EACH

Manufactured by *Monash-Younker Co.*

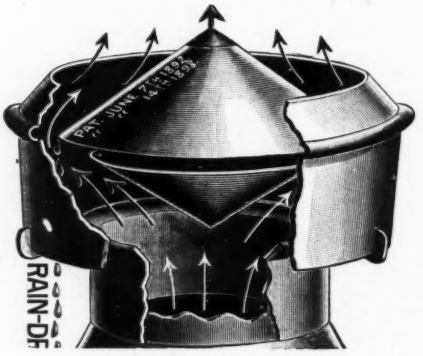
203 S. CANAL STREET CHICAGO

43 CENTRE STREET NEW YORK

"Pancoast" Ventilators

GREATEST EFFICIENCY AND LOWEST PRICES ARE OUR GREAT STRONG POINTS.

We have had the "PANCOAST" VENTILATORS in competition with other makes—in factories atthe Cornell University and in thousands of cases of actual use—and the results have always been the same.



Sizes 2 in. to 10 ft.

THE "PANCOAST" WAS FOUND SUPERIOR TO ALL OTHERS, WITH PRICES ENTIRELY SATISFACTORY.

Write for model and catalogue.

National Pancoast Ventilator Company

Main Office: 223 & 225 S. 5th St., Philadelphia. Branch Offices: New York, Boston and Chicago.

WALLACE L. PIERCE, PRESIDENT
GEO. B. LITTLE, VICE-PRESIDENT

OSBORN B. HALL
GEN'L MANAGER MECHANICAL DEPT.

GEO. T. COPPINS, SECRETARY
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Walworth Manufacturing Co.

TOOLS AND SUPPLIES

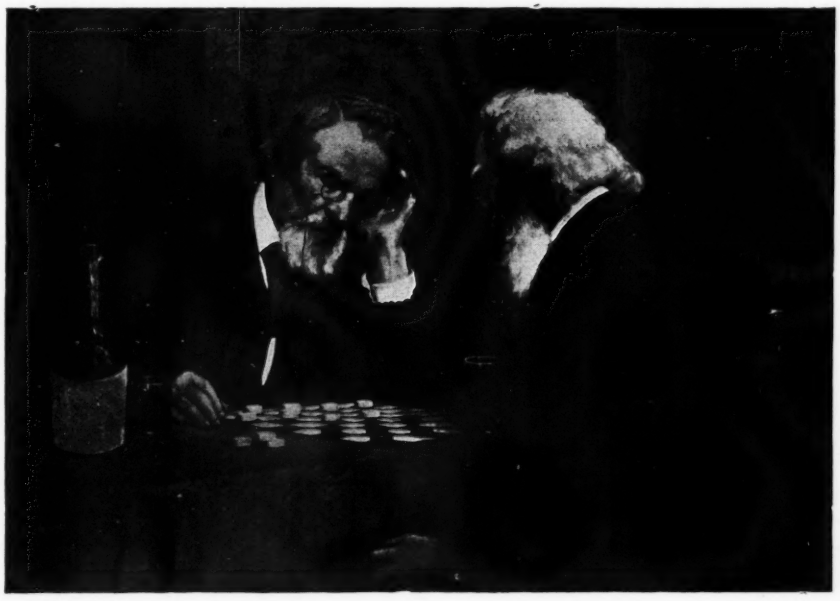
FOR STEAM, WATER AND GAS USERS

ESTABLISHED
1842

INCORPORATED
1872

128 TO 136 FEDERAL STREET
BOSTON, MASS., U. S. A.

NEW YORK OFFICE, PARK ROW BLDG.
FACTORY, SOUTH BOSTON



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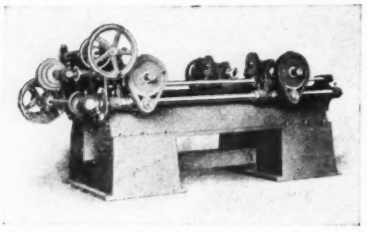
AMERICAN
PROCESS
ENGRAVING
CO.

15-27 West Sixth Street
CINCINNATI, O.

Makers of
Fine
CATALOGUE
ILLUSTRATIONS

This 4 Spindle Heater Drill

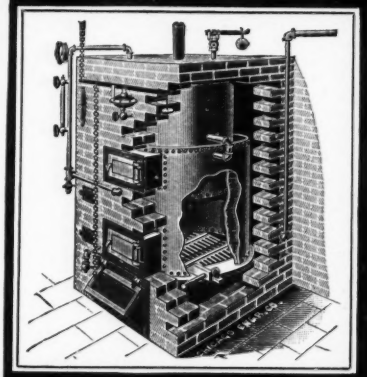
is designed for boring, facing and tapping radiator, heater and boiler sections.
Spindles have both hand and power feed, quick advance



and return and automatic stop, and will bore and face four 5 inch holes at once.
We build also a six spindle machine for making three-part sections. See new catalog for description of 4 spindle radiator drill.

The Bickford Drill & Tool Co.
CINCINNATI, OHIO, U. S. A.

KEWANEE BOILER COMPANY
KEWANEE ILL.



MANUFACTURERS OF
HAXTUN STEEL BOILERS FOR HOT WATER AND STEAM HEATING

"TABASCO" WATER HEATERS
ALL STEEL SELF FEEDERS
SEND FOR SPECIAL CATALOGUES
169 LAKE ST.
·CHICAGO·

STANDS ALL TESTS
IN ORDER TO OBTAIN THE BEST RESULTS IN RADIATION IT IS NECESSARY TO USE

The Argon Automatic Air Valve

It is the only one on the market equally efficient on both Steam and Hot Water Radiators.

TESTED FOR AIR
TESTED FOR GAS
TESTED FOR STEAM
TESTED FOR WATER
TESTED FOR SERVICE
TESTED FOR PERFECTION
AND NOT FOUND WANTING
EVERY ORDER BRINGS
ITS DUPLICATE

INTERIOR VIEW.

EXTERIOR VIEW

Steam Heaters, Contractors and Fitters are not acquainted with the best Valve on the market, unless they have tried the ARGON.

The decision of experts, evinced not only in opinion, but as the result of experience, is that the

ARGON VALVES DO THE WORK
ARGON VALVES ARE RELIABLE

Need No Adjustment
Are Guaranteed

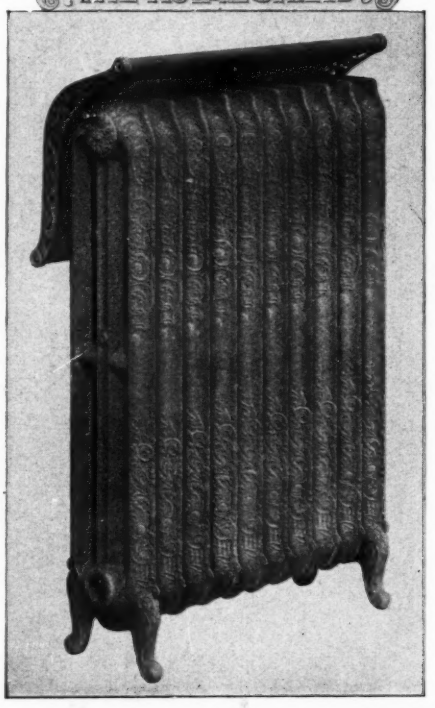
WRITE FOR SAMPLE

The Argon Manufacturing Company
DENVER, COLORADO.

Place Orders Now for

The Royal Shield

THE ROYAL SHIELD



The best on the market for the following reasons:

- Stronger in construction
- Neater in appearance
- More easily attached and detached
- Takes up less space
- Lower in price than any other made
- Can be attached to any radiator

We guarantee these shields to be on a par with the high standard we have always maintained.

Write for Circular and Price List.

Twin Burner Vapor Stove Company
206-210 S. 17th Street, ST. LOUIS. MO.

The Champion

Water Filters

ARE

Germ Proof and Give Perfect Satisfaction

MADE IN

FIVE STYLES AND FOURTEEN SIZES.

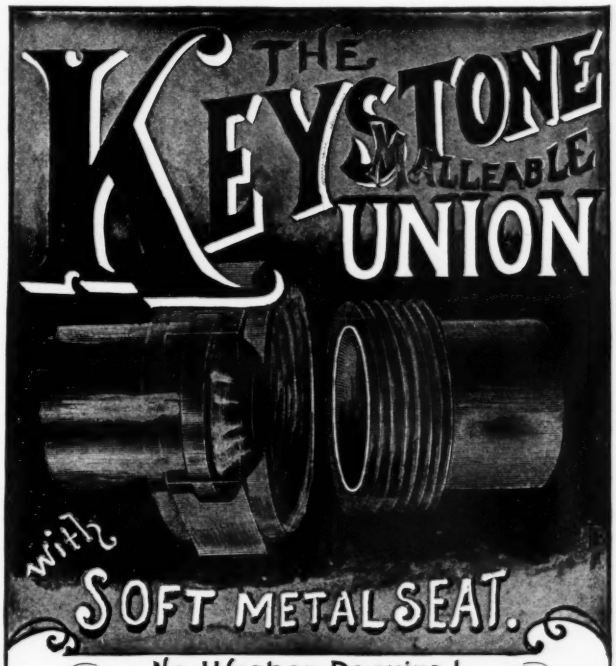
Secure a profitable Agency.

Catalogue and Prices upon application.

THE

Champion Safety Lock Co.

95 Woodland Ave., Cleveland, Ohio, U.S.A.



No Washer Required.

STANLEY G. FLAGG & CO.

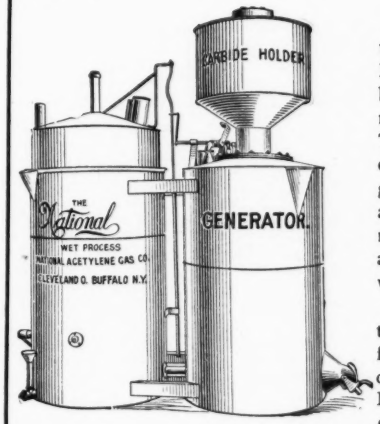
Sole Manufacturers,

220 Broadway, **NEW YORK.**

19th St. & Penn. Ave. **PHILADELPHIA.**

FOR SALE BY DEALERS EVERYWHERE.

The New National



The only machine on the market which can be loaded with enough carbide to run 30 days or more without recharging. The only machine which does not produce after-generation when lights are turned off. The only machine which does not allow the gas to escape while recharging.

The carbide is fed into the water in a granulated form, thereby insuring cool, pure gas at all times. By our process of purification we are enab'ed to use Acetylene gas for cooking and running gas engines. The new National is fully approved by all the Boards of Fire Underwriters throughout the United States. **Local and General Agents Wanted**

Boston National Acetylene Gas Co.

17 State Street, Boston, Mass.

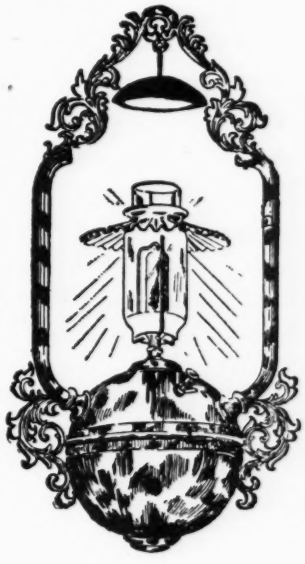
500 CANDLE POWER AIR PRESSURE

Search-Light Vapor Lamps

Cost one-tenth as much to run as an electric arc light of same power.

We make one hundred candle power Vapor Lamps in a variety of styles.

Best illuminators for stores, homes, streets, etc. Sells rapidly.



Each Lamp is fully guaranteed.

Samples sent on approval to the trade.

Write for catalogue to-day.

Search-Light Manufacturing Company

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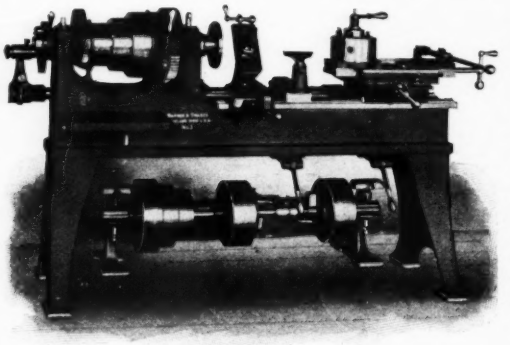

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With Geared Friction Head, Compound Turret and Chasing Attachment

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The Acme No. 15

Will please your trade. It heats more water with a smaller Gas Consumption than any other Heater on the market.

It is 28 inches high and 12 inches in diameter

List price, nickel plated,

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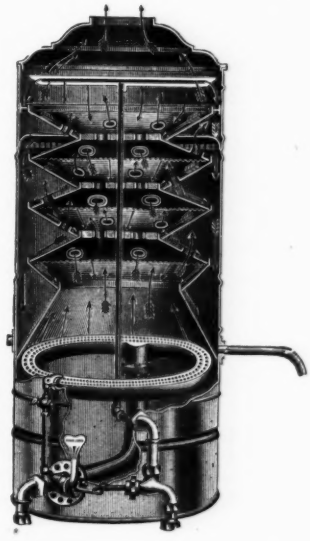
IT HAS A LARGER HEATING SURFACE CONSIDERING ITS SIZE, THAN ANY OTHER HEATER ON THE MARKET.



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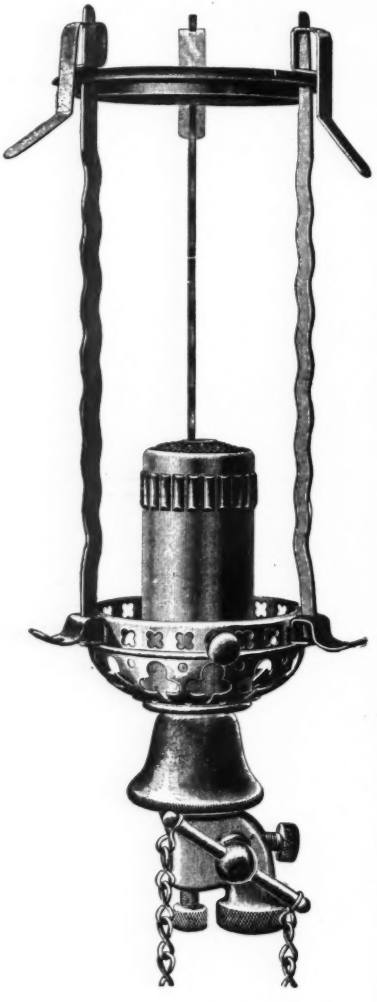
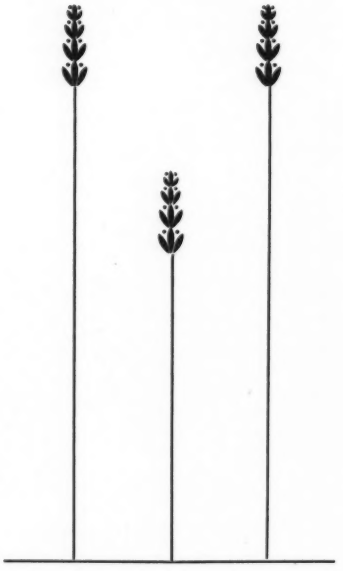


Incandescent Gas Burner



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Crescent Instantaneous Water Heaters

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No house complete without this most perfect device

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No. 6 Heater, $25.00

Height 30 inches
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Net weight 45 pounds
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Height 30 inches
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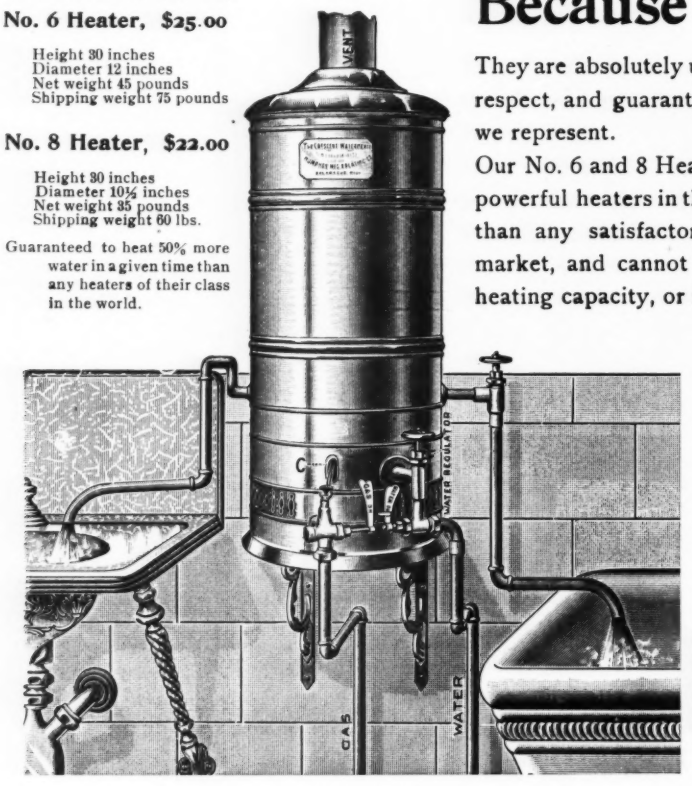
Guaranteed to heat 50% more water in a given time than any heaters of their class in the world.



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Because

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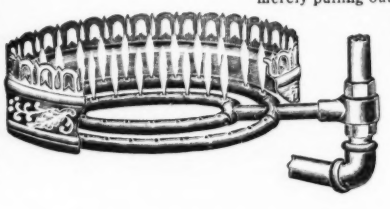

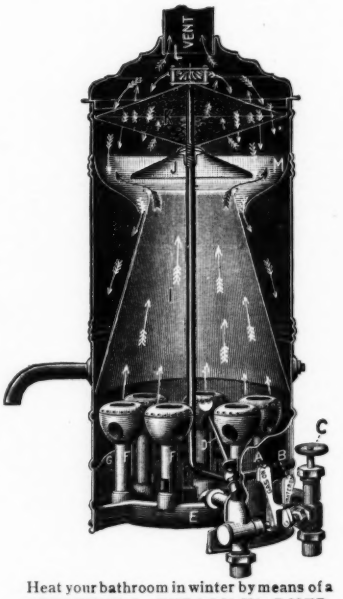

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PARIS
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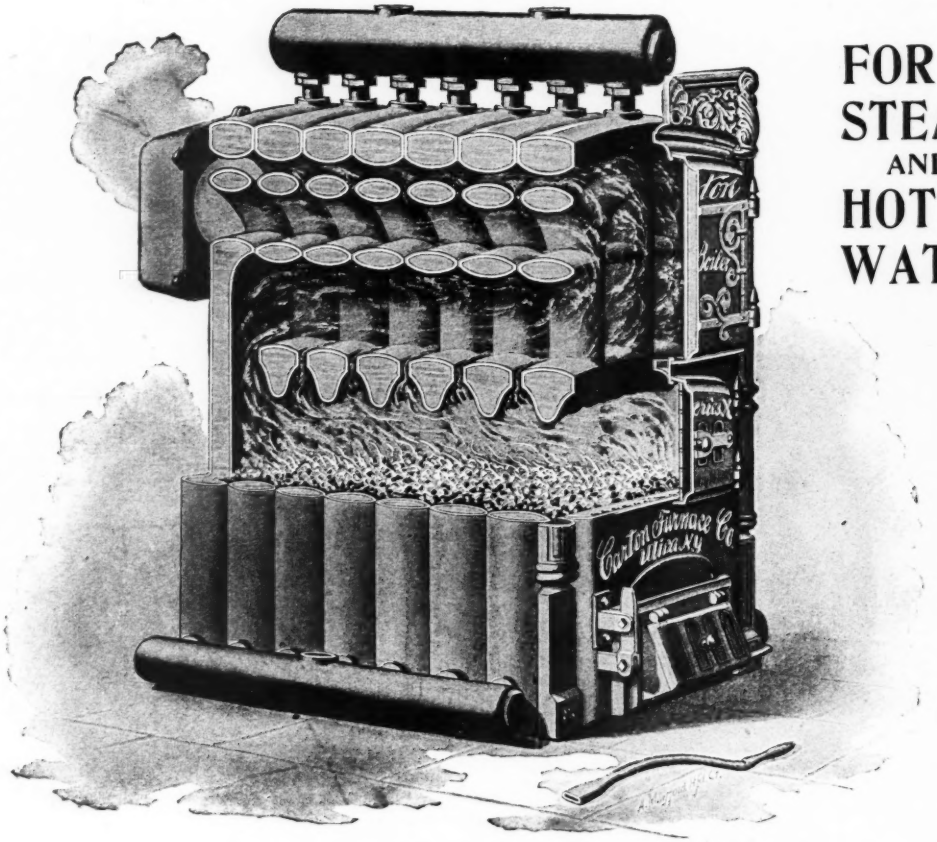

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75 PER CENT. FIRE SURFACE

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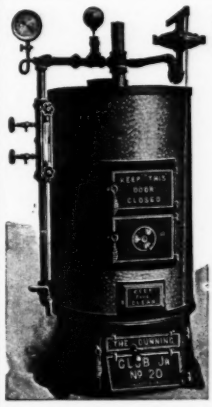

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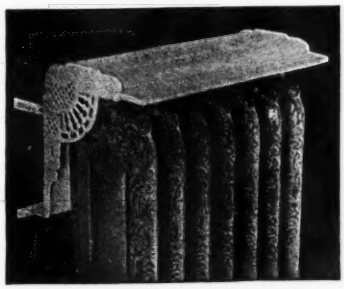

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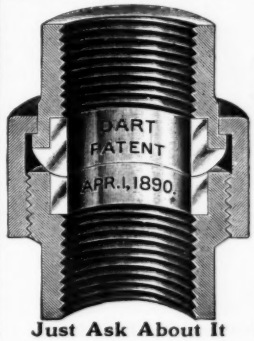

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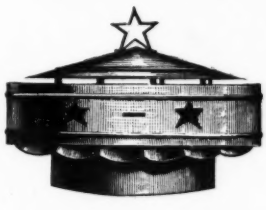

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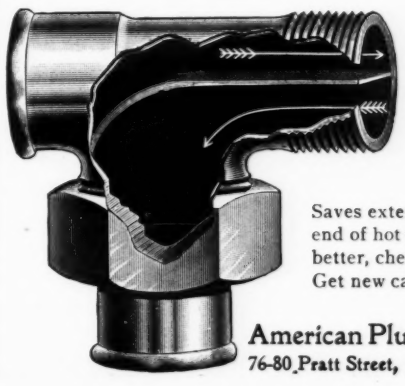

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Saves extension of pipe to further end of hot water radiators. Makes better, cheaper and neater work. Get new catalog of this new thing.

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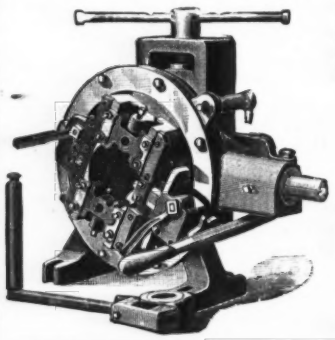

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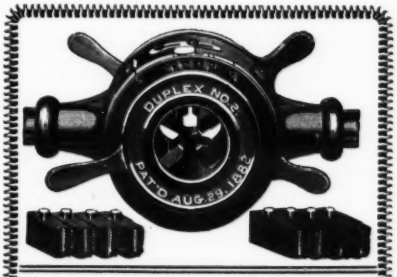

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DUPLEX ADJUSTABLE STOCKS and DIES should be in the hands of every PLUMBER AND PIPE FITTER. DO YOU OWN ONE? Let us mail you list and quote prices : : : : :

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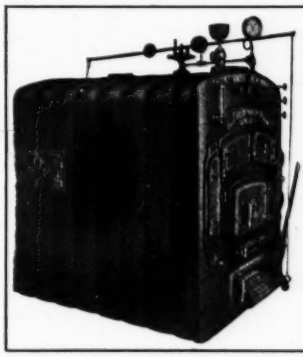

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Sectional—Self Contained—Surface Burning—19 sizes—Capacities 350 to 4000 sq. ft.—Any size can readily be enlarged—Let us send you Free our new Catalogue and Fitter's Hand Book of valuable information for Practical Fitters. **Write for them to-day.**

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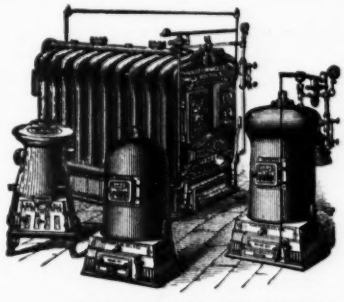

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Square feet of Water Radiation 100 to 6,000
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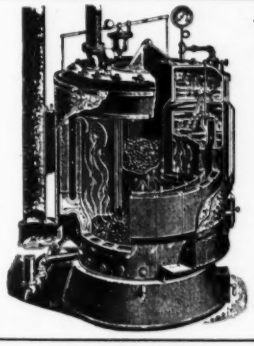

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Is infinitely better than red or white lead for making steam, gas or water pipe joints. Joints will be tighter, and can be broken months or years after without damage to pipes or tools. **IT WILL PAY EVERY PIPEFITTER TO SEND FOR SAMPLE AND CIRCULAR.**

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For tapping water and gas mains against pressure. It leads them all. Sold on approval. Taps mains from 3 to 30 inches. No saddles required for different sized mains. Weight, complete, only 18 lbs. A boy 12 years old can make a connection in 15 minutes. Get prices from

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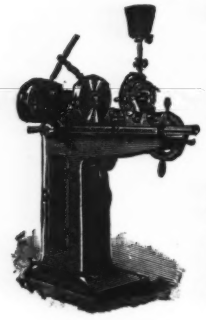
Always ready for instant use.



Malleable and Gray Iron Pipe Fittings

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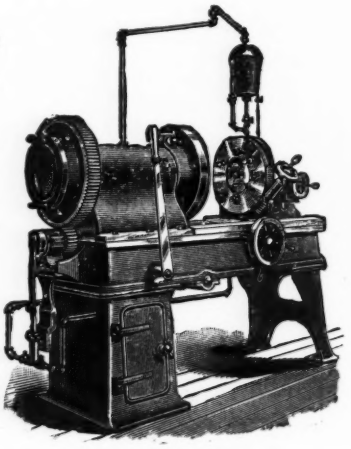

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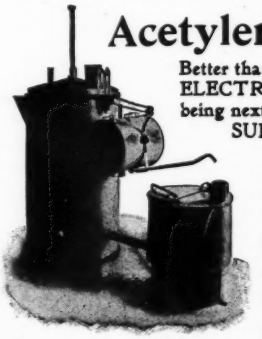
Acetylene Gas



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This is what people say of the

Cline Acetylene Gas Machine...

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Yours respectfully,

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WHEN PROPERLY APPLIED TO A SMOKE PIPE

Saves

TIME
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Besides Making Additional Heat

SEND FOR CIRCULAR AND TRADE DISCOUNTS

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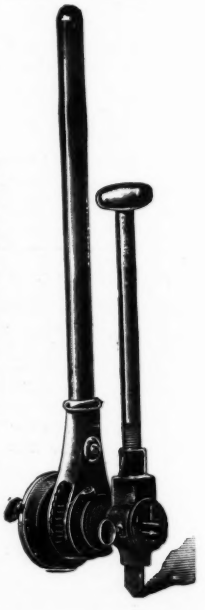

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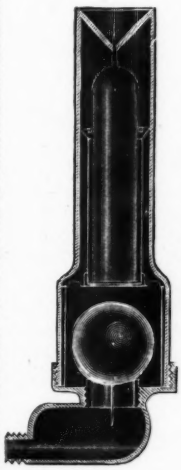

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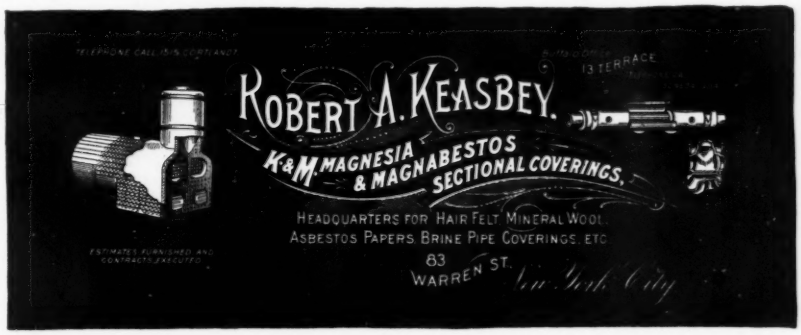
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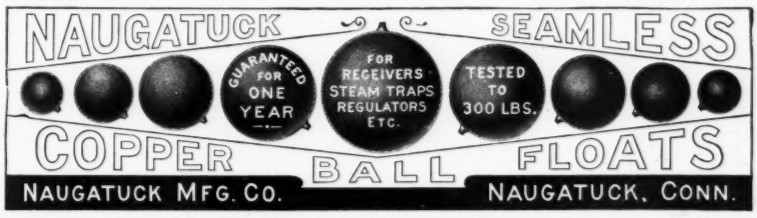

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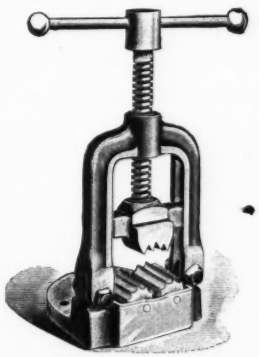

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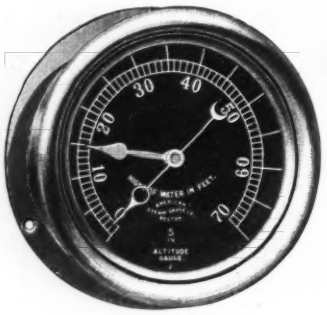

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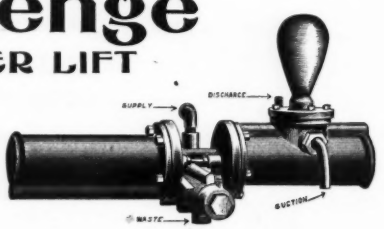

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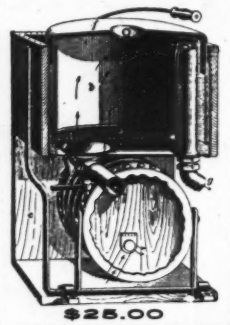

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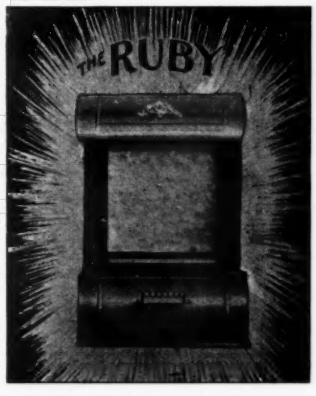

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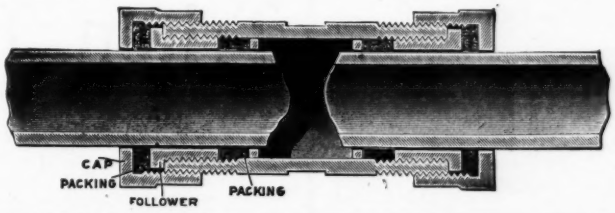

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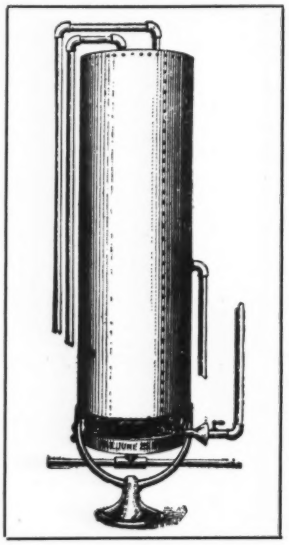

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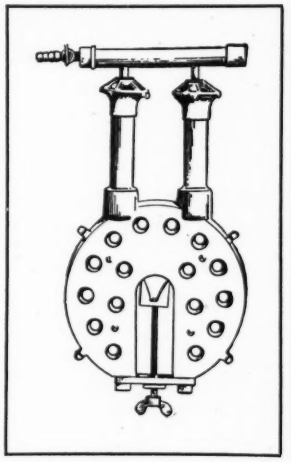

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Whole No. 135 JANUARY FIFTEENTH, NINETEEN HUNDREDAND ONE Vol. 20, No. 4

The Albany Water Filtration Plant.

By Allen Hazen, C. E., New York City.

ALBANY, N. Y., was originally supplied with water by gravity from reservoirs on small streams west and north of the city. In time, with increasing consumption, the supply obtained from these sources became inadequate, and an additional supply from the Hudson river was introduced. The water was obtained from the river through a tunnel under the Erie basin, and a pumping station was erected in Quackenbush street to pump it to reservoirs, one of which served also as the distributing point for one of the gravity supplies. The intake, which was used first in 1873, drew water from the river opposite the heart of the city. In recent years, the amount of water drawn from this source has greatly exceeded that obtained from the gravity sources.

Some of the city sewers enter the river above this intake, but most of them are below it. In times of flood, the water thus obtained was polluted by the sewage of only a few of the city sewers; at low-water stages, however, owing to the tidal currents, the water contained much sewage, which was carried up stream to the intake, and the sewage of the city was thus present, in very considerable amount, in its own water supply.

In addition to the pollution from local sources, the river receives the sewage of Troy and the surrounding cities, seven or eight miles above, and that of Schenectady, Utica, Rome, and many other places farther away.

Under these conditions the typhoid fever death rate in Albany was excessive. Prof. W. P. Mason, of Troy, made a report in 1885 upon the quality of the water, in which he stated that the water as then used was a source of disease, and should be abandoned at the earliest practicable date. Following this, an attempt was made to secure a ground-water supply, but without results. Studies were then made for gravity sources of supply, mentioned in the reports of the Board of Water Commissioners for the years 1891 to 1893; but the necessary legislation was not obtained.

In 1896 the Board investigated methods of purifying the present supply. The matter was studied by the Board and by its superintendent, Mr. George I. Bailey, and in January, 1897, the author was engaged to examine the studies which had been made, and to report upon the projects presented. His report recommended the general scheme previously outlined by the superintendent, namely, to abandon the present intake, and to establish a new one about two miles farther up the river, at a point above all the local sources of pollution, and to pump the water by low-lift pumps to a settling basin, from which it would flow to sand filters, and thence through a pure-water conduit to the present pumping station in Quackenbush street.

The report was accepted, and the recommendations adopted, and the necessary funds were provided; and, in July, 1897, the preparation of plans was begun.

As the pure-water conduit was to be placed in the Erie canal, and as the work of constructing it necessarily had to be done during the season of closed navigation; plans for this part of the work were prepared first. The contract was let in November, 1897, and that part of the work under the canal was completed before navigation opened, May 1, 1898.

The contract for the filters and sedimentation basin was awarded in February, 1898, and work was commenced in April; but, owing to various reasons connected with the installation of a very elaborate contractors' plant, work was not pushed actively until August, 1898. Contracts for the pumping machinery, and for the pumping station and intake, were let in June and August, 1898, and the work was carried out during the fall and winter. Construction was sufficiently advanced so that a part of the plant was put in operation on July 27, 1899. The old intake was closed on September 6, 1899, since which time no unfiltered river water has been pumped to the city.

Source of Supply.

The source of supply is the Hudson river, which, at the point of intake, has a drainage area of 8,240 square miles.

*Presented as an informal talk at the Syracuse convention of the New England Water Works' Association. In its present form the paper is abstracted by the editor from one read by Mr. Hazen before the American Society of Civil Engineers on January 3, 1900.

Of this, 4,570 square miles are tributary to the Hudson above Troy, 3,502 are tributary to the Mohawk, and 168 are tributary to the Hudson below the Mohawk.

No gagings of the river at this point are available. The average annual flow of the stream probably amounts to at least 1,000,000 gallons per square mile per day, or over 8,000,000,000 gallons per day. The minimum flow is only a small fraction of this amount. Mr. George W. Rafter, who has made a study of the flow of the Upper Hudson,* estimates the minimum flow at Mechanicsville at 0.24 cubic foot per second per square mile of tributary drainage area. Assuming that this figure applies to the whole of the Hudson above Troy, and taking a somewhat lower figure, namely, 0.15 cubic foot per second per square mile, for the discharge of the Mohawk and of the Hudson below Troy, we arrive at a minimum flow of the Hudson at Albany of 1,657 cubic feet per second, or 1,060,000,000 gallons per twenty-four hours, being, in round numbers, 100 times the average amount of water now taken from the river for water works purposes, and at least fifty times the maximum.

Without entering into a detailed discussion, it may be said that the amount of sewage, with reference to the size of the river and the volume of flow, is a fraction less than that at Lawrence, Mass., but the pollution is much greater than that of most American rivers from which municipal water supplies are taken.

Position of Intake.—The intake of the plant is opposite a long narrow island. The land upon which the filter plant is built fronts the back channel of the river. This back channel carried formerly a considerable proportion of the river's flow, but, to improve navigation, the United States Government has constructed a dike, the top of which is about five feet above low water, and this dike cuts off most of the flow through this channel at ordinary river stages. At flood stages the dike is overtopped, and the channel takes a large amount of water.

The question arose, whether to build an intake across the back channel and the island to the main channel of the river, or to take water from the more convenient back channel. Each point had its advantages. To determine the relative character of the water, examinations were made by Dr. George Blumer, of the Bender Hygienic Laboratory, of Albany They show, in a general way, that the water in the back channel was considerably better than that in the main channel. Occasionally, there was but little difference, and this would always be the case when the river was in flood. At no time was the water in the back channel materially worse than in the main channel.

One of the city sewers enters the river at a point a short distance from the outlet of the back channel, and there was a possibility that sewerage therefrom would be carried up this channel by flood tides. On the other hand, the water in the main channel had come directly from the Troy sewers, while that in the back channel was more or less completely cut off from the main current, and was moved back and forth by the tides, and opportunities for natural purification were present in greater degree than in the main channel. These conditions, apparently, more than offset the possible admixture of fresh sewerage.

*Report of the State Engineer and Surveyor for 1895, p. 119.

Description of Plant.

The filter plant, and all structures connected therewith, are shown in Figs. 3 to 14, and this description, for the most part, will be limited to those points which are not thus shown.

Intake.—The intake to the filters consists of a simple structure in the form of a box, having an open top covered with rails 6 inches apart, and connected below, through a 36-inch pipe, with a well in the pumping station. Before going to the pumps the water passes through a screen with bars 2 inches apart, so arranged as to be raked readily. The rails over the intake and this screen are intended to stop matters which might obstruct the passageways of the pumps, but no attempt is made to stop fish, leaves, or other floating matters which may be in the water. The arrangement, in this respect, is like that of the filter at Lawrence, Mass., where the raw water is not subjected to close screening. There is room, however, to place finer screens in the pump well, should they be found desirable.

Pumps.—The centrifugal pumps have a guaranteed capacity of 16,000,000 gallons per 24 hours against a lift of 18 feet, or 12,000,000 gallons per 24 hours against a lift of 24 feet, corresponding to a water-horse-power, in either case, of 50.5. The ordinary pumping at low water is against the higher lift, and under these conditions either pump can supply the ordinary consumption, the other being held in reserve. The plant is arranged, however, so that if for any reason a large quantity of water is required when only one pump can be used, water can be pumped directly to the filters against the lower head, in which case one pump will deliver a larger quantity, up to 16,000,000 gallons, the full nominal capacity of the plant.

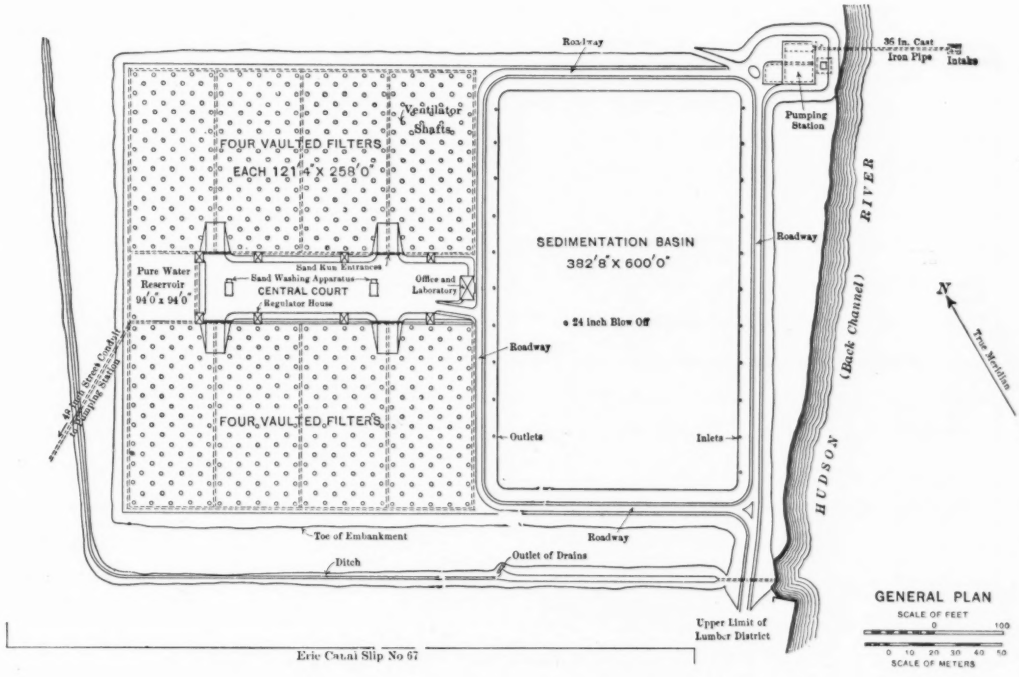
Pumping Station.—The pumping station building, to a point above the highest flood-level, is of massive concrete construction, without openings. Nearly all the machinery is necessarily below this level, and in high water the sluice gates are closed, and the machinery is thus protected from flooding. The superstructure is of pressed brick, with granite trimmings

Meter for Raw Water.—Upon leaving the pumping station the water passes through a 36-inch Venturi meter having a throat diameter of 17 inches, the throat area being two-ninths of the area of the pipe. This meter records the quantity of water pumped, and is also arranged to show on gages in the pumping station the rate of pumping.

Aeration.—After leaving the meter, the water passes to the sedimentation basin through eleven outlets. These outlets consist of 12-inch pipes on end, the tops of which are 4 feet above the nominal flow line of the sedimentation basin. Each of these outlet pipes is pierced with 296 ⅜-inch holes extending from 0.5 to 3.5 feet below the top of the pipe. These holes are computed so that when 11,000,000 gallons of water per day are pumped, all the water will pass through the holes, the water in the pipes standing flush

with the tops. The water is thus thrown out in 3,256 small streams, and becomes aerated. When a larger quantity is pumped, the excess flows over the tops of the outlet pipes in thin sheets, which are broken by the jets.

Regarding the necessity for aeration, no observations have been taken upon the Hudson River, but, judging from experience with the Merrimac, at Lawrence, where the conditions are in many respects similar, the water is, for the greater part of the year, nearly saturated with oxygen, and aeration is not necessary. During low water in summer, however, there is much less oxygen in the water, and at these times aeration is a distinct advantage. Further, the river water will often have a slight odor, and aeration will



tend to remove it. The outlets are so arranged that they can be removed readily, if they are not found necessary.

Sedimentation Basin.—The sedimentation basin has an area of 5 acres and is 9 feet deep. To the overflow, it has a capacity of 14,600,000 gallons, and, to the flow line of the filters, 8,900,000 gallons. There is thus a reserve capacity of 5,700,000 gallons between these limits, and this amount can be drawn upon, without inconvenience, for maintaining the filters in service while the pumps are shut down. This allows a freedom in the operation of the pumps, which would not exist with the water supplied directly to the filters.

The sedimentation basin is built on the river bank, largely above the natural surface of the soil. The sides are embankments made of clay obtained in excavating for the filters, mixed with gravel dredged from the river. These materials were put down in alternate 3-inch layers, wetted, and harrowed, and were rolled with 3-ton grooved rollers on the top of each gravel layer until the gravel was forced down into and thoroughly embedded in the clay. The embankments made in this way are extremely solid, stand vertically when cut, are not readily washed, and no leakage through them has appeared at any point. The outside of the embankments are covered with soil, and the inside and bottom with 16 inches of puddle, which is protected from frost on the sides by a covering of gravel, above which is a rough blue-stone pavement.

The puddle was made by mixing equal volumes of the clay obtained in excavating for the filters, and mixed sand and gravel obtained from the river by dredging. It differed from the material of the embankments only in more thorough mixing, and greater care in placing. The materials were mixed in a pug mill. It was soon found that the best mixing was secured with rather large quantities of water, while the best ramming required that the materials should not be too wet. Accordingly, the materials were mixed wet, given a preliminary ramming, allowing to stand two or three days, and afterwards given the final ramming. The puddle was put down in three layers, and the concrete rested directly upon it. The concrete was put down in blocks about 7 feet square, with ½-inch joints, extending halfway from top to bottom, filled with asphalt. The maximum rate of placing puddle was about 3,000 cubic yards per month.

The water enters the sedimentation basin from eleven inlets along one side and is withdrawn from eleven outlets directly opposite. The inlets and aerating devices previously described bring the water into the basin without current, and evenly distributed along one side. Both inlets and outlets are controlled by gates, so that any irregularities in distribution can be avoided.

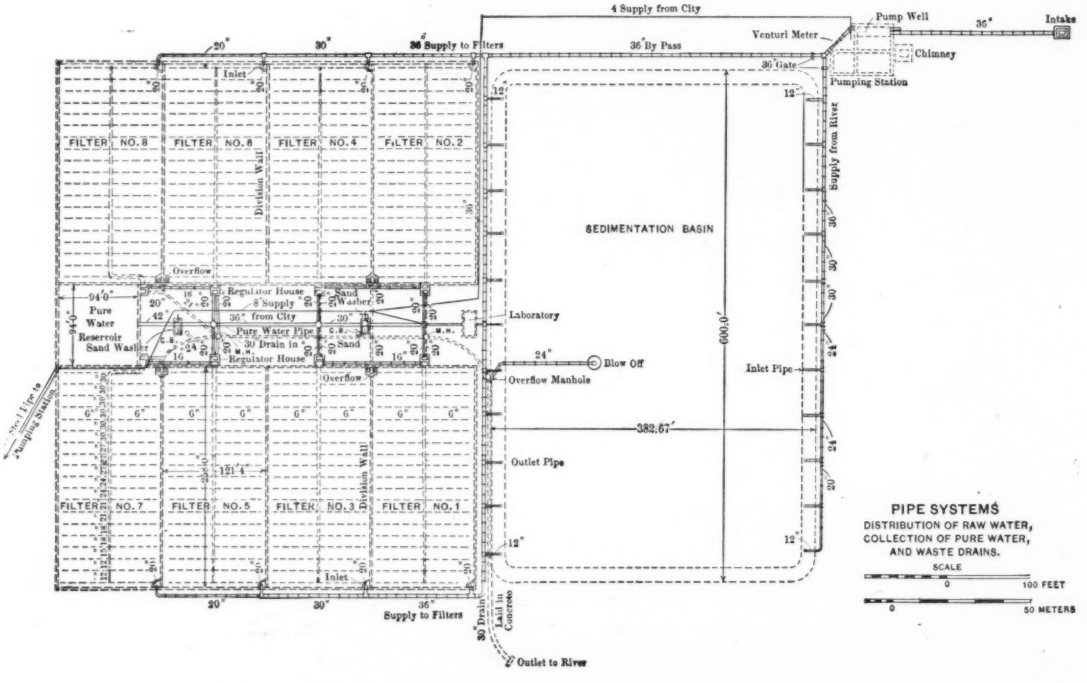
The floor of the sedimentation basin is built with even slopes from the toe of each embankment to a sump, the

heights of these slopes being 1 foot, whatever their lengths. The sump is connected with a 24-inch pipe leading to a large manhole in which there is a gate through which water can be drawn to empty the basin. There is an overflow from the basin to this manhole, which makes it impossible to fill the basin above the intended level.

Filters.—The filters are contained in masonry chambers and are covered to protect them against the winters, which are quite severe in Albany. The piers, cross-walls, and linings of the outside walls, entrances, etc., are of vitrified brick. All other masonry is concrete. The average depth of excavation for the filters was 4 feet, and the material at the bottom was usually blue or yellow clay.

of the piers, and each pier being the center of one square. The manholes are in alternate sections, and are of concrete, built in steel forms with castings at the tops, securely jointed to the concrete.

Above the vaulting there are 2 feet of earth and soil, grassed on top. The tops of the manholes are 6 inches above the soil to prevent rain water from entering them. The drainage of the soil is effected by a depression of the vaulting over each pier, partially filled with gravel and sand, from which water is removed by a 2-inch tile drain going down the center of the pier and discharging through its side just above the top of the sand in the filter. The saving in cost by this arrangement was considerable, as the



Floors.—The floors consist of inverted, groined, concrete arches, arranged to distribute the weight of the walls and vaulting over the whole area of the bottom.

Walls.—For the outside walls the brick linings, 8 inches thick, were built first to the full height. A certain number of bricks were laid endwise, and projected into the concrete. These occupied about 4 per cent of the area of the wall. Afterwards, wooden forms were put up on the outside, and the concrete backing was filled in.

Vaulting.—The concrete vaulting was placed on wooden centers supported on wedges which could be knocked out after the concrete had set, so that the centers came down readily, and could be moved forward and used again. Some of them were used four or five times in the course of the work, the only repairs necessary being the patching of the lagging, and were in good order at the end of the work. The vaulting was designed with a clear span of 12 feet, a rise of 2½ feet, and a thickness of 6 inches at the crown, but the clear span was reduced to 11 feet 11 inches to fit the sizes of the bricks in the piers. It was put in in squares, the joints being on the crowns of the arches parallel to the lines

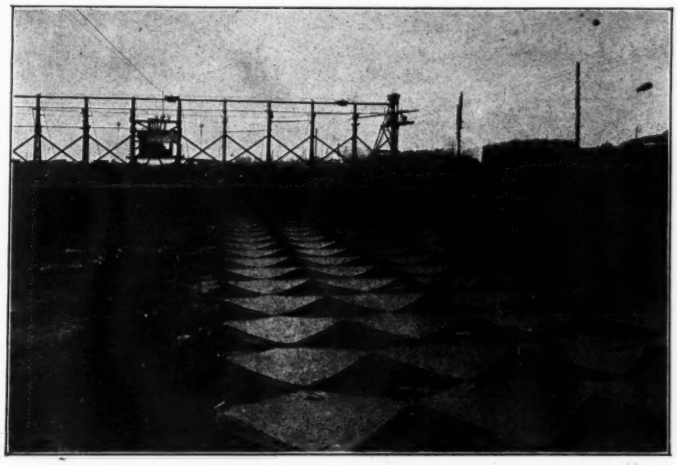
cost of the drains was much less than that of the concrete which would have been necessary to fill the areas over the piers had any other system been adopted. Further, the water entering in this way is as good as any water available, and there is every reason for adding it to the supply before it passes through the filters.

In order to provide ready access to each filter, a part of the vaulting near one side is elevated and made cylindrical in shape, making an inclined runway from the sand level to a door, the threshold of which is 6 inches above the level of the overflow. This sand-run is provided with permanent timber runways and with secure doors.

The vaulting is similar, in many respects, to that of the covered filters at Ashland, Wis., and at Somersworth, N. H., but differs from that vaulting in that it is entirely of concrete, instead of brick backed by concrete.

Underdrains.—The main underdrains for removing the filtered water are of vitrified pipe surrounded by concrete, and are entirely below the floors of the filters. They were put in before the construction of the filters was commenced, and the concrete surrounding them was brought to the

plane of the bottom of the foundations, so that when the floor was built it went over them continuously, without breaking in any way the line of inverted arches. This arrangement was adopted because the drains would have been in the way if they had been placed entirely above the floor, and if any part of the drain had been placed in the normal floor-span it would have reduced the strength of the inverted arches, and would itself have been liable to breakage by their pressure. As the surrounding material is clay or tight rock, no danger of loss of water by seepage can result from this arrangement.



Placing the Floor of a Filter.

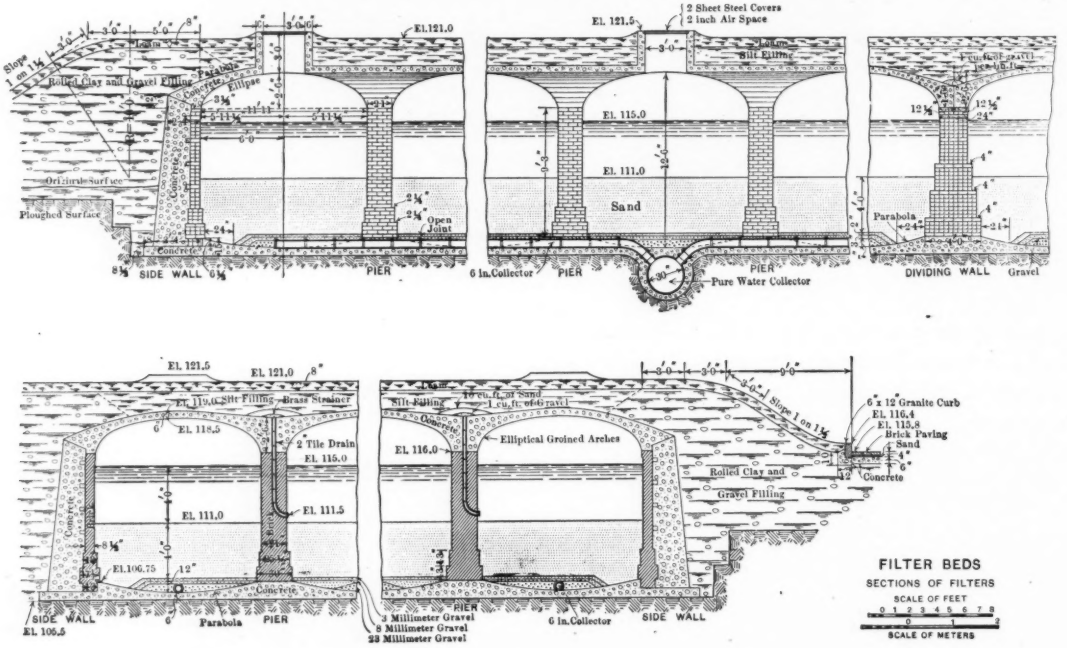
The main collectors are 30-inch vitrified pipes, reduced by castings to 20 inches at the outlet, and the effluent from each filter passes through a 20-inch gate. The underdrains are made much larger than would ordinarily be required for carrying the quantities of water involved. The reason for this is that after a filter has just been scraped, the frictional loss in passing the sand is very slight. If the friction of the underdrainage system is not kept very low, there will be so much loss of head that when a filter is started the pull exerted at remote parts of the filter will be less than at points near the outlet, and thus the parts near the outlet will operate at rates which are too high, while the more remote parts will hardly filter at all, and the resulting purification is less than it should be. The underdrainage system is so designed that, when starting a filter after cleaning, the friction of the sand is about 50 mm. at a rate of 3,000,000 gallons per acre daily, and the loss of head in the underdrainage system is estimated at 10 mm. This very low friction, which is necessary, is obtained by the use of ample sizes for the underdrains and low velocities in them. In the outlet and measuring devices moderate losses of head are not objectionable, and these pipes and connections are, therefore, smaller than the main underdrains.

Building the Brick Piers.

Connections with the drain are made through thirty-eight 6-inch outlets in each filter, passing through the floor and connecting with 6-inch lateral drains running the whole width of the filter. These drains were made with pipes having one side of the bell cut off, so that they would lie flat on the floor and make concentric joints, without having to

be wedged. They were laid with a space of about 1 inch between the barrels, leaving a large opening for the admission of water from the gravel

Filter Gravel.—The gravel surrounding the underdrains is of three grades. The material was obtained from the river bed by dredging, and was of the same stock as that used for preparing ballast for the concrete. It was separated and cleaned by a special, cylindrical, revolving screen. The coarsest grade of gravel was that which would not pass round holes 1 inch in diameter, and free from stones more than about 2 inches in diameter. At first it was required to pass a screen with holes 2 inches in diameter, but this screen removed many stones which it was desired to retain, and the screen was afterwards changed to



per gravel layers were shown directly by the joints in the brick work of the piers.

The form of construction made it best to put a lateral drain in each section, or 13 feet 8 inches apart on centers. The drain itself occupies 7 inches, and the longest course which water has to pass in the gravel, in any event, is about 6½ feet. This distance is so short that the frictional resistance of the filtered water in passing through the gravel is extremely small, and, therefore, it was possible to vary the gravel sections somewhat according to the relative amounts of gravel of the several grades obtained in screening, without detriment to the work. The thickness of the 3-mm. gravel was varied between 2 and 2½ inches, according to the supply available, and similar variations were made in the

have holes 3 inches in diameter. The intermediate grades of gravel passed the 1-inch holes, and were retained by a screen with round holes 3-8 inch in diameter. The finest gravel passed the above screens and was retained by a screen with round holes 3-16 inch in diameter. The gravel was washed, until free from sand and dirt, by water played upon it during the process of screening, and it was afterwards taken over screens in the chutes where it was separated from the dirty water, and, when necessary, further quantities of water were played upon it at these points.

The 23-mm. gravel entirely surrounded the 6-inch pipe drains, and was carried slightly above their tops. In some cases it was used to cover nearly the whole of the floor, but this was not insisted upon.

The 8-mm. gravel was obtained in larger quantity than the other sizes, and was used to fill all spaces up to a plane 2 1-2 inches below the finished surface of the gravel, this layer being about 2 inches thick over the tops of the drains, and somewhat thicker elsewhere.

The 3-mm. gravel was then applied in a layer 2½ inches deep, and the surface leveled. The grades for the two upper gravel layers were shown directly by the joints in the brick work of the piers.

other grades; but the finished surface of the gravel was always kept at the same elevation.

Filter Sand.—The preliminary estimates of cost were based upon the use of filter sand from a bank near the filter site. Further examination showed that this sand contained a considerable quantity of lime, and it was found by experiment with a small filter constructed for that purpose that the use of this sand would harden the water by about 2 parts in 100,000, and the amount of lime contained in the sand, namely, about 7 per cent, was sufficient to continue this hardening action for a considerable number of years. This was regarded as a serious objection to its use, and the specifications were drawn limiting the amount of lime in the sand, thus excluding all of the local bank sands. The river sands which were used were nearly free from lime, and in the end the sand as secured was probably not only free from line, but more satisfactory in other ways, and also cheaper than the bank sand would have been.

The specifications of the filter sand require that—

"The filter sand shall be clean river, beach or bank sand, with either sharp or rounded grains. It shall be entirely

free from clay, dust or organic impurities, and shall, if necessary, be washed to remove such materials from it. The grains shall, all of them, be of hard material, which will not disintegrate, and shall be of the following diameters: Not more than 1 per cent by weight less than 0.13 mm., nor more than 10 per cent less than 0.27 mm.; at least 10 per cent by weight shall be less than 0.36 mm. and at least 70 per cent by weight, shall be less than 1 mm., and no particles shall be more than 5 mm. in diameter. The diameters of the sand grains will be computed as the diameters of spheres of equal volume. The sand shall not contain more than 2 per cent, by weight, of lime and magnesia taken together and calculated as carbonates."

General View of Vaulting under Construction.

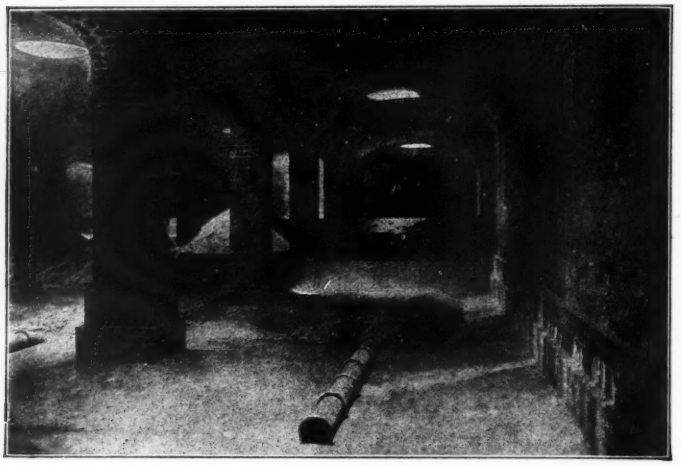
With the river sand and the method of handling adopted by the contractors, it was possible to control the quality of the sand, so that the specifications were complied with. In the lower layers of two of the filters a little sand was allowed which contained a few particles above 5 mm. in diameter. The screens were adjusted afterwards so that the largest remaining particles were less than 4 mm. in diameter. The filter sand has effective sizes of from 0.29 to 0.32 mm., averaging 0.31; and uniformity coefficients from 2.2 to 2.5, averaging 2.3.

The sand and also the gravel were delivered in the filters through the manholes, temporary plank roadways being built for that purpose. Trucks carrying 1½ cubic yards, with a pair of horses, were driven over the vaulting in all directions, without hesitation and without damage to it. The sand was dumped on plank platforms constructed below. A record was kept of all the planks used for this purpose, and they were required to be taken up in the presence of inspectors afterwards to prevent the possibility of leaving any of them in the filter. This arrangement necessitated working over all the sand underneath the points of dumping, and it thereby became loosened from the excessive packing caused by dumping it from a height. The sand was deposited in three horizontal layers, so that, if by accident sand of unusual quality was placed at any point, the same kind of sand would not extend from top to bottom.

Outside Wall, ready for Concrete Backing.

Sand-washing Apparatus.—Most of the suspended mat-

ters in the filtered water are held by the top layer of sand, and this layer is removed from time to time. The dirty sand is washed, and eventually replaced in the filters. Two large ejector sand-washing machines are provided at convenient places between the filters. In them the dirty sand is mixed with water, and is thrown up by an ejector, after which it runs through a chute into a receptacle, from which it is again lifted by another ejector. It passes in all through five ejectors, part of the dirty water being wasted each time. The sand is finally collected from the last ejector, where it is allowed to deposit from the water.

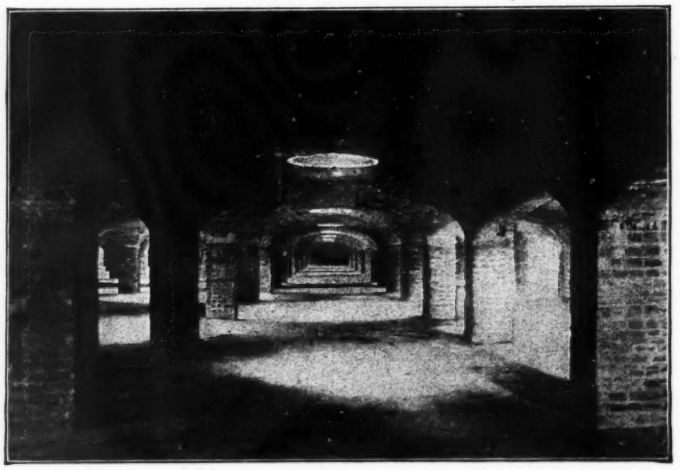


Interior of a Filter: Drain, Gravel and Sand Layers.

Sand washers of this kind have been used for many years by some of the London water companies, and more recently at Hamburg; and also at Lawrence and Poughkeepsie in this country.

Inlets to Filters.—Water is admitted to each filter through a 20-inch pipe from a pipe system connection with the sedimentation basin. Just inside of the filter wall is placed a standard gate and beyond that a balanced valve connected with an adjustable float to shut off the water when it reaches the desired height on the filter. These valves and floats were constructed from special designs, and are similar in principle to valves used for the same purpose in the Berlin water filters.

Overflows.—Each filter is provided with an overflow, so arranged that it cannot be closed, which prevents the water level from exceeding a fixed limit in case the balanced valve fails to act. An outlet is also provided near the sand-run, so that unfiltered water can be removed quickly from the surface of the filter, should it be necessary, to facilitate cleaning.

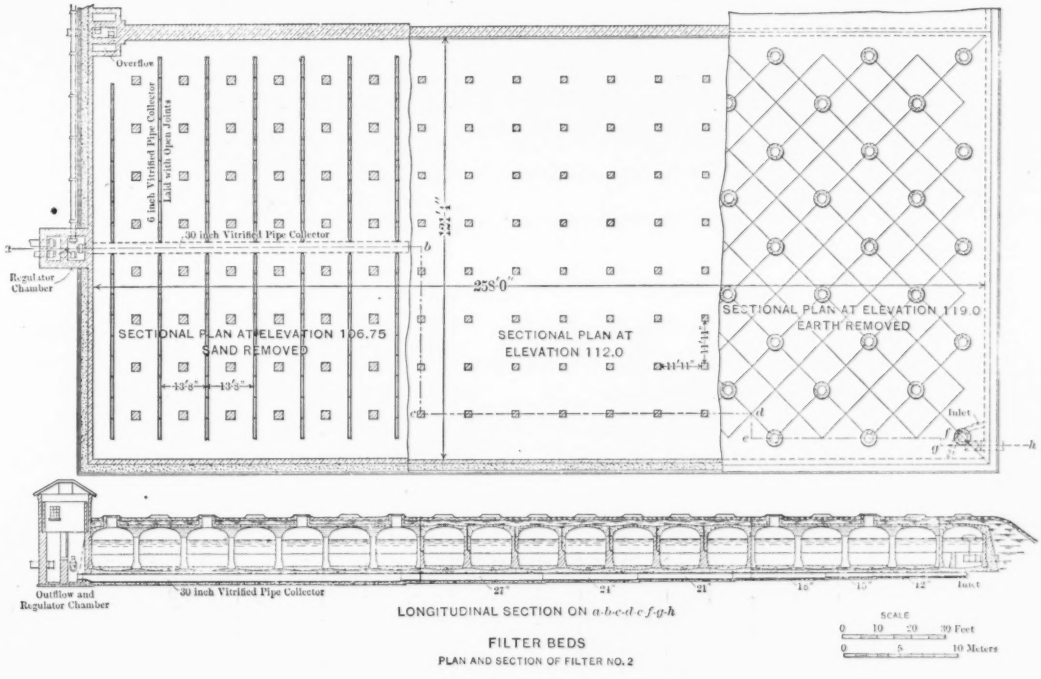


Interior of a Filter, ready for use.

Filter Outlets.—The outlet of each filter is through a 20-inch gate controlled by a standard graduated to show the exact distance the gate is open. The water rises in a chamber and flows through an orifice in a brass plate 4 by 24 inches, the center of which is 1 foot below the level of the sand line. At the normal rate of filtration, 3,000,000 gallons per acre daily, 1 foot of head is required to force the water through the orifice. With other rates the head

increases or decreases approximately as the square of the rate and forms a measure of it. With water standing in the lower chamber, so that the orifice is submerged, it is assumed that the same rate will be obtained with a given difference in level between the water on the two sides of the orifice, as from an equal head above the center of the orifice when discharging into air.

Measurement of Effluent.—In order to show the rate of filtration two floats are connected with the water on the two sides of the orifice. These floats are counterbalanced; one carries a graduated scale and the other a marker which moves in front of the scale and shows the rate of filtration corresponding to the difference in level of the water on the two sides.


Overflow
6 inch Vitrified Pipe Collector Laid with Open Joints
30 inch Vitrified Pipe Collector
Regulator Chamber
259'0"
SECTIONAL PLAN AT ELEVATION 106.75 SAND REMOVED
SECTIONAL PLAN AT ELEVATION 112.0
SECTIONAL PLAN AT ELEVATION 119.0 EARTH REMOVED
Inlet
Outflow and Regulator Chamber
30 inch Vitrified Pipe Collector
LONGITUDINAL SECTION ON a-b-c-d-e-f-g-h
SCALE
0 10 20 30 Feet
0 5 10 Meters

FILTER BEDS
PLAN AND SECTION OF FILTER NO. 2

When the water in the lower chamber falls below the center of the orifice, the water in the float chamber is, nevertheless, maintained at this level. This is accomplished by making the lower part of the tube water-tight, with openings just at the desired level, so that when the water falls below this point in the outer chamber it does not fall in the float chamber. To prevent the loss of water in the float chamber by evaporation, or from other causes, a lead pipe is brought from the other chamber and supplies a driblet of water to it constantly; this overflows through the openings, and maintains the water level at precisely the desired point. The floats thus indicate the difference in water level on the two sides of the orifice whenever the water in the lower chamber is above the center of the orifice; otherwise, they indicate the height of water in the upper chamber above the center of the orifice, regardless of the water level in the lower chamber. The scale is graduated to show the rates of filtration in millions of gallons per acre of filtering area. In computing this scale the area of the filters is taken as 0.7 acres, and the coefficient of discharge as 0.61.

At the ordinary rates of filtration the errors introduced by the different conditions under which the orifice operates will rarely amount to as much as 100,000 gallons per acre daily, or one thirtieth of the ordinary rate of filtration. Usually they are much less than this. The apparatus thus shows directly, and with substantial accuracy, the rate of filtration under all conditions.

Measurement of Loss of Head.—Two other floats with similar connections show the difference in level between the water standing on the filter and the water in the main drain pipe back of the gate, or, in other words, the frictional resistance of the filter, including the drains. This is commonly called the loss of head, and increases from 0.2 foot or less, with a perfectly clean filter, to 4 feet, with the filter ready for cleaning. When the loss of head exceeds 4 feet the rate of filtration cannot be maintained at 3,000,000 gallons per acre daily with the outlet devices provided, and, in order to maintain the rate, the filter must be cleaned.

The outlets of the filters are connected in pairs, so that filtered water can be used for filling the underdrains and sand of the filters from below prior to starting, thus avoiding the disturbance which results from bringing dirty water upon the sand of a filter not filled with water.

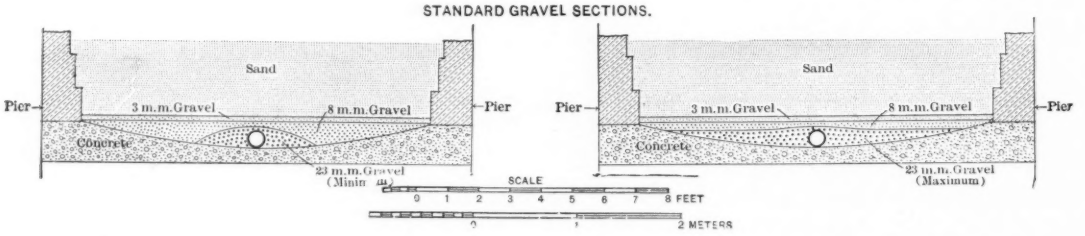
Laboratory Building.—The scientific control of the filters is regarded as one of the essentials to the best results, and to provide for this there is a laboratory building at one end of the central court between the filters and close to the sedimentation basin, supplied with the necessary equipment for full bacterial examinations, and also with facilities for observing the colors and turbidities of raw and filtered waters, and for making such chemical examinations as may

be necessary. This building also provides a comfortable office, dark room and storage room for tools, etc., used in the work.

Pure-water Reservoir.—A small pure-water reservoir, 94 feet square, and holding about 600,000 gallons, is provided at the filter plant. The construction is similar to that of the filters, but the shapes of the piers and vaulting were changed slightly, as there was no necessity for the ledges about the bottoms of the piers and walls; while provision is made for taking the rain water, falling upon the vaulting above to the nearest filters instead of allowing it to enter the canal, should the water be removed from the pipe for the reservoir. The floor and roof of the reservoir are at the same levels as those of the filters.

Pure-water Conduit.—The filtered water is taken from the pure water reservoir to the present pumping station through 7,913 feet of 48-inch pipe. For 5,450 feet the pipe is laid under the Erie Canal, and for 1,837 feet through Montgomery street, with an average cut of 22 feet. The pipe is not under pressure, and is made of mild open-hearth steel plates, 5-16 inch thick.

STANDARD GRAVEL SECTIONS.



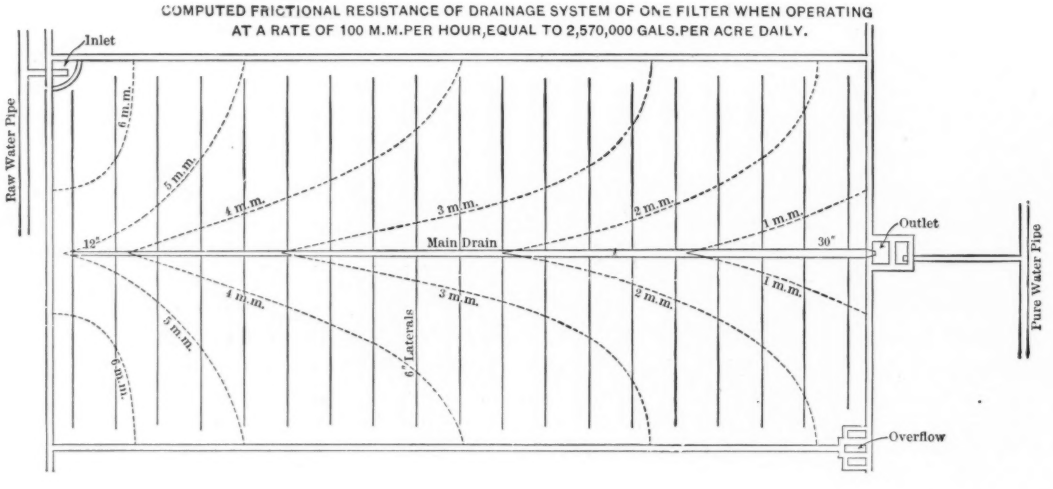
Concrete Backing.—Pipe of this thickness is not stiff enough to withstand the earth pressures in the deep cut in Montgomery street, without being badly deformed, and is not heavy enough to be safe from the danger of floating in the canal, should the water be removed from the pipe for any reason. Concrete was therefore used to support the sides of the pipe in the deep cut and to weight it under the canal. The amount of concrete required for these purposes was considerable, and the board decided to use a further amount in order to surround the pipe entirely. This makes a concrete pipe with a minimum thickness of 6 inches outside of the steel pipe for practically the whole distance, capable of supporting the earth, and able itself to serve as a conduit even if the steel pipe should be removed entirely, although in that case it would not be thoroughly water-tight. For 567 feet on hard clay bottom, the concrete on the bottom was omitted, the natural material being probably equivalent to the concrete. For about 300 feet at the upper end, in shallow cut and where the pipe is readily accessible, the concrete was also omitted.

Coating.—The pipe was coated by dipping in asphalt, and after calking tight on the inside, all imperfections in the coating, due to calking or otherwise, were covered with melted asphalt in connection with a naphtha lamp. Where the spots were not too large the asphalt on the sides came together when softened by the flame and covered the spot completely without the addition of new material. Where the uncovered patches were large this was not possible. The place was first heated, then melted asphalt was applied and thoroughly heated and melted until it incorporated itself with the old asphalt on the edges.

The greatest difficulty was experienced in repairing breaks in the coating directly on the bottom of the pipe; although these were not serious, owing to the fact that all men who worked therein were required to wear rubbers, and thus the damage done to the coating was slight. Repairs were made by building dams of cotton waste on each side of the defective place and sponging out the water, after which the plates could be heated by a naphtha lamp and repaired in the usual way.

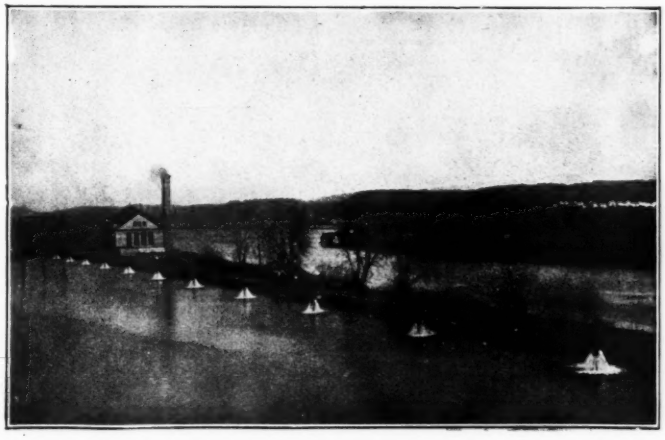
Brick Work.—All the brick work, except that in the superstructures, was of vitrified paving brick. This brick was not specified, but the specifications required brick ab-

COMPUTED FRICTIONAL RESISTANCE OF DRAINAGE SYSTEM OF ONE FILTER WHEN OPERATING AT A RATE OF 100 M.M. PER HOUR, EQUAL TO 2,570,000 GALS. PER ACRE DAILY.



sorbing not more than 12 per cent of water by weight. The local brick-makers were unwilling to take the trouble to make brick hard enough to meet this requirement, and the contractors decided finally to use a second-quality paving brick. With this, the absorption ranged from 1 to 11 per cent, and averaged 4 per cent by weight.

Cracks.—With cold weather, some of the joints in the concrete vaulting opened slightly, indicating the absence of arch action, but no cracks in the blocks have been observed at any point. A few cracks appeared in the walls, none of which was of serious consequence.

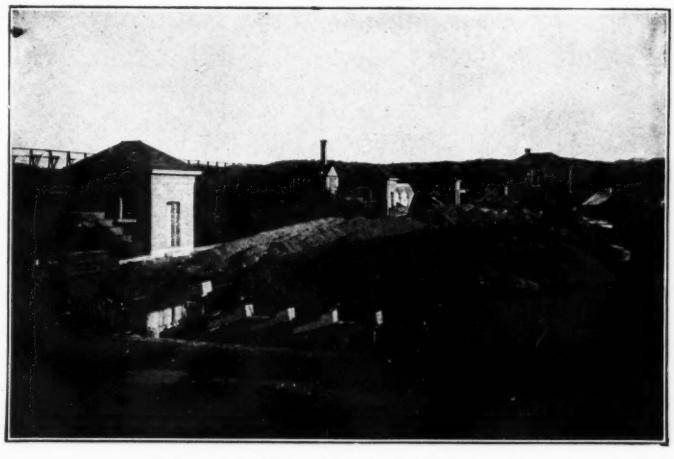


Sedimentation Basin, Pumping Station, and Outlets.

Capacity of Plant and Means of Regulation.

The various filters have effective filtering areas of from 0.702 to 0.704 acre, depending upon slight differences in the thickness of the walls in different places. For the purpose of computation, the area of each filter is taken at 0.7 acre. The normal rate of filtration is taken as 3,000,000 gallons per acre daily, at which rate each filter will yield 2,100,000 gallons daily, and, with one filter out of use for the purpose of being cleaned, seven filters normally in use will yield 14,700,000 gallons. The entrances and outlets are all made of sufficient size, so that rates 50 per cent greater than the foregoing are possible. The capacities of the intake, pumping station, and piping are such as to supply any quantity of water which the filters can take, up to an extreme maximum of 25,000,000 gallons in 24 hours. The pure-water conduit from the filters to Quackenbush street is nominally rated at 25,000,000 gallons per 24 hours, after it has become old and somewhat tuberculated. In its present excellent condition it will carry a larger quantity.

At the pumping station at Quackenbush street there are three Allis pumps, each capable of lifting 5,000,000 gallons per 24 hours. In addition to the above there are the old reserve pumps with a nominal capacity of 10,000,000 gallons per 24 hours, which can be used if necessary, but which require so much coal that they are seldom used. For practical purposes the 15,000,000 gallons represents the pumping capacity of this station and also the capacity of the filters, but the arrangements are such that in case of emergency the supply can be increased to 20,000,000 or even 25,000,000 gallons for a short time.



Central Court Showing Sand Washer, Dirty Sand etc.

The water is pumped through rising mains to reservoirs holding 37,000,000 gallons, not including the Tivoli low-service reservoir, which is usually supplied from gravity sources. The reservoir capacity is such that the pumping can be suspended at Quackenbush street for considerable periods if necessary, and in practice it has been suspended at certain times, especially on Sundays. The amount of

water required is also somewhat irregular. The drainage areas supplying the gravity reservoirs are much larger, relatively, than the reservoirs, and at flood periods the volume of the gravity supply is much greater than that which can be drawn in dry weather. Thus it happens that, at certain seasons of the year, the amount of water to be pumped is but a fraction of the nominal capacity of the pumps, and at these times it is possible to shut the pumps down for greater lengths of time.

Capacity of Pure-Water Reservoir.—The storage capacity provided between the filters and the Quackenbush street pumps is comparatively small, namely, 600,000 gallons, or one hour's supply at the full nominal rate. A larger basin, holding as much as one-third or one-half of a day's supply, would be in many respects desirable in this position, but the conditions were such as to make it practically impossible. The bottom of the reservoir could not be put lower without deepening and increasing greatly the expense of the conduit line. On the other hand, the flow line of the reservoir could not be raised without raising the level of the filters, which was hardly possible upon the site selected. The available depth was thus limited between very narrow bounds, and to secure a large capacity would have necessitated a very large area, and consequently a great expense. Under these circumstances, and especially in view of the abundant storage capacity for filtered water in the distributing reservoirs, it was not deemed necessary to secure a large storage, and only so much was provided as would allow the pumps to be started at the convenience of the engineer, and give a reasonable length of time for the filters to be brought into operation. For this the pure-water reservoir is ample, but it is not enough to balance any continued fluctuations in the rate of pumping.

Method of Regulating and Changing the Rate of Filtration.—With all the Allis pumps running at their nominal capacity, the quantity of water required will just about equal the normal capacity of the filters. When only one or two pumps are running, the rate of filtration can be reduced. With the plant operating up to its full capacity, the water level in the pure-water reservoir will be below the level of the standard orifices in the filter outlets. When the rate of pumping is reduced, if no change is made in the gates controlling the filter outlets, the water will gradually rise in the pure-water reservoir and in the various regulator chambers, and will submerge the orifices and gradually reduce the head on the filters, and consequently the rates of filtration, until those rates equal the quantity pumped. In case the pumping is stopped altogether, the filters will keep on delivering at gradually reduced rates until the water level in the pure-water reservoir reaches that of the water on the filters.

When the pumps are started up, after such stoppage or reduced rate of pumping, the water levels in the pure-water reservoir and in the gate chambers will be lowered gradually, and the filters will start to operate at first with extremely low rates which will increase gradually until the water is depressed below the orifice, when they will again reach the rates at which they were last set. The regulators during all this time will show the rate of filtration on each filter, and, if any inequalities occur which demand correction, the gates on the various outlets can be adjusted accordingly.

The arrangement, in this respect, combines some of the features of the English and German plants. In the English plants the filters are usually connected directly with the clear-water basin, and that in turn with the pumps, and the speed of filtration is required to respond to the speed of the pumps, increasing and decreasing with it, being regulated at all times by the height of water in the pure-water reservoir. This arrangement has been subject to severe criticism, because the rate of filtration fluctuates with the consumption, and especially because the rates of filtration obtained simultaneously in different filters may be different. There was no way to determine at what rate any individual filter was working, and there was always a tendency for a freshly scraped filter to operate much more rapidly than those which had not been scraped for some time.

This led to the procedure, first formulated by the Commission of German Water Works Engineers in 1894, and provided for in most of the German works built or remodeled since that time, of providing pure-water storage sufficient in amount to make the rate of filtration entirely independent of the operation of the pumps. Each filter was to be controlled by itself, be independent of the others, and deliver its water into a pure-water reservoir lower than itself, so that it could never be affected by back-water, and so large that there would never be a demand for sudden changes in the rate of filtration.

This procedure has given excellent results in the German works; but it leads oftentimes to expensive construction. It involves, in the first place, a much greater loss of head in passing through the works, because the pure-water reservoir must be lower than the filters, and the cost of the pure water reservoir is increased greatly because of its large size. The regulation of the filters is put upon the attendants entirely, or upon automatic devices, and regulation by what is known as "responding to the pumps" is eliminated.

More recently the German authorities have shown less disposition to insist rigidly upon the principles advanced in 1894. In a compilation of the results of several years' experience with German water filters, Dr. Pannwiz* makes a statement of particular interest, of which a free translation is as follows:—

"Most of the German works have sufficient pure-water reservoir capacity to balance the normal fluctuations in consumption, so that the rate of filtration is at least independent of the hourly fluctuations in consumption. Of especial importance is the superficial area of the pure-water reservoir. If it is sufficiently large there is no objection to allowing the water level in it to rise to that of the water upon the filters. With very low rates of consumption during the night the filters may work slowly and even stop, without damage to the sediment layers when the stopping and starting take place slowly and regularly, because of the ample reservoir area.

"The very considerable fluctuations from day to day, especially those arising from unusual and unforseen occur-

*Arbeiten aus dem Kaiserlichen Gesundheitsampte, Vol. XIV, p. 260.

rences, are not provided for entirely by even very large and well-arranged reservoirs. To provide for these without causing shock, the rate of filtration must be changed carefully and gradually, and the first essential to success is a good regulation apparatus."

"Responding to the pumps" has a great deal to recommend it. It allows the pure-water reservoir to be put at the highest possible level, it reduces to a minimum the loss of head in the plant, and yet provides automatically, and without the slightest trouble on the part of the attendants, for the delivery of the required quantity of water by the filters at all times. If the filters are connected directly to the pumps there is a tendency for the pulsation of the pumps to disturb their operation, even if the pumps are far removed; and this exists where filters are connected directly to the pumps, and a pure-water reservoir is attached to them indirectly. By taking all the water through the pure-water reservoir and having no connection except through it, this condition is absolutely avoided, and the pull on the filters is at all times perfectly steady.

Much has been said as to the effect of variation in the rate of filtration upon the efficiency of filters. Experiments have been made at Lawrence and elsewhere which have shown that, as long as the maximum rate does not exceed a proper one, and under reasonable regulations, and with the filter in all respects in good order, no marked decrease in efficiency results from moderate fluctuations in rate. There is probably a greater decrease of efficiency by stopping the filter altogether, especially if it is done suddenly, than by simply reducing the rate. The former sometimes results in loosening air bubbles in the sand, which rise to the surface and cause disturbances, but this is not often caused by simple change in rate.

On the whole, there is little evidence to show that, within reasonable limits, fluctuations in rate are objectionable, or should be excluded entirely, especially in such cases as at Albany, where arrangements to prevent them would have resulted in very greatly increased first cost. The inferior results sometimes obtained with the system of "responding to the pumps" as it existed in earlier works, and still exists in many important places, undoubtedly arises from the fact that there is no means of knowing and controlling the simultaneous rate of filtration in different filters, and that one filter may be filtering two or three times as fast as another, with nothing to indicate it.

This contingency is fully provided for in the Albany plant. The orifices are of such size that even with a filter just scraped and put in service, with the minimum loss of head, with the outlet gate wide open, and with the water level in the pure-water reservoir clear down,—that is, with the most unfavorable conditions which could possibly exist, the rate of filtration cannot exceed 5,000,000 or 6,000,000 gallons per acre daily, or double the nominal rate. This rate, while much too high for a filter which has just been cleaned, is not nearly as high as was possible, and in fact actually occurred in the old Stralau filters at Berlin, and in many English works; and, further, such a condition could only occur through the gross negligence of the attendants, because the rate of filtration is indicated clearly at all times by the gages. These regulating devices have been specially designed to show the rate with unmistakable clearness, so that no attendant, however stupid, can make an error by an incorrect computation from the gage heights. It is believed that the advantage of clearness by this procedure is much more important than any increased accuracy which might be secured by refinements in the methods of computation, which should take into account variations in the value of the coefficient of discharge, but which would render direct readings impossible.

In designing the Albany plant the object has been to combine the best features of German regulation with the economical and convenient features of the older English system, and filters are allowed to respond to the pumps within certain limits, while guarding against the dangers ordinarily incident thereto.

Results of Operation.

The filters were designed to remove from the water the bacteria which cause disease. They have already reached a bacterial efficiency of over 99 per cent, and it is expected that their use will result in a great reduction in the death rate from water-borne diseases in the city. They also remove a part of the color and all of the suspended matters and turbidity, so that the water is satisfactory in its physical properties.

The filters have reached, with perfect ease, their rated capacity, and on several occasions have been operated to deliver one-third more than this amount; that is to say, at a rate of 4,000,000 gallons per acre daily. They are operated by Mr. George I. Bailey, superintendent of the Albany Water Works.

Cost of Construction.

The cost of the filtration plant complete is shown by Table No. 1. As some of the accounts are not yet closed. Table No. 3. As some of the accounts are not yet closed, a few of the items, designated by stars (*) are estimated, and are subject to slight change with the closing of all the accounts.

The filters, sedimentation basin, and pure-water reservoir are connected in such a way as to make an exact separation of their costs impossible; but, approximately, the sedimentation basin cost $60,000, the pure-water reservoir $9,000, and the filters $255,000. The sedimentation basin thus cost $4,100 per million gallons capacity; and the filters complete, including all piping, cost $45,600 per acre of net filtering area, exclusive of land and engineering.

Table No. 1.—Approximate Cost of Filtration Plant Complete.

Land		$8,290.00
Pumping Station:		
Pumping machinery, boilers, etc.	$22,000.00	
Intake	3,800.00	
Pump well, gates, screens, and foundations	6,285.00	
Pumping station building	12,167.00	
Chimney	1,540.00	
Venturi meter	1,560.00	
Extra work and minor items	2,393.00*	
		49,745.00*

Filters, Sedimentation Basin and Pure-water Reservoir:—		
Preliminary draining	$1,956.71	
70,672 cu. yds. excavation, at (average) $0.3079+	21,761.64	
16,040 cu. yds. rolled clay and gravel embankment, at $0.52.	8,340.80	
22,851 cu. yds. silt and loam filling, at $0.15	3,427.65	
23,439 cu. yds. general filling rolled, at $0.18	4,219.02	
12,550 cu. yds. puddle, at $0.715	8,973.25	
1,775 cu. yds. gravel for lining, at $0.85	1,508.75	
2,257 sq. yds. split stone lining, at $0.82	1,850.74	
11,737 cu. yds. concrete in floors, at $2.31	27,112.47	
Carried forward	$79,151.03	58,035.00*
7,792 cu. yds. concrete in vaulting, at $3.85	29,999.20	
3,147 cu. yds. all other concrete, at $2.13	6,703.11	
4,382 cu. yds. brick work, at $8.125	35,603.75	
31,715 barrels Portland cement, at $1.935	61,368.53	
7,281 cu. yds. filter gravel, at $1.05	7,645.05	
36,488 cu. yds. filter sand, at $1.	36,488.00	
Cast iron pipes and specials, placed, including placing gates.	21,841.25	
Gates and valves	6,714.23	
Vitrified pipe, complete	7,153.32	
672 filter manhole covers, at $4.40.	2,956.80	
8 sand-run fixtures, at $407.50.	3,260.00	
8 regulator houses, at $862.24.	6,897.92	
1 office and laboratory	4,881.00	
Vitrified brick paving	2,158.00	
Iron fence about court	1,704,00	
Extra work and all minor items.	9,692.01	
		324,217.20
Conduit and Connections with Quackenbush Street Pumping Station:—		
7,913 ft. 48-in. steel pipe, at $4.50.	$35,608.50	
24,218 cu. yds. excavation, at (average) $0.855+	20,715.60	
3,144 cu. yds. concrete, at $5	15,720.00	
Gates and connections with pumping station	3,680.00	
Sewer and railroad crossings, sheeting, and all other items.	10,914.12	
		86,638.22
Engineering, inspection, printing etc		31,000.00*
Total approximate cost of work		$499,890.42*

The preliminary estimate of cost submitted to the board, February 8, 1897, amounted to $478,000. The work will actually cost, in round numbers, $22,000, or 4.6 per cent more than the preliminary estimate. The preliminary estimate, and the actual costs by more important divisions, are as follows:—

	Preliminary estimate, Feb. 8, 1897.	Approximate actual cost.
Land	$10,000	$8,290
Pumping station and intake	34,000	49,745
Filter and sedimentation basin, with piping	327,000	324,217
Pure-water conduit and connection with Quackenbush Street pumping station	64,000	86,638
Engineering and contingencies	43,000	31,000
Total	$478,000	$499,890

The excess in the cost is in the pumping station and conduit line. The cost of the conduit line was increased by surrounding it with concrete, which was not included in the preliminary estimate, and also by certain changes in the location required by the canal authorities. The pumping station also was made more elaborate and expensive than was contemplated in the preliminary estimate. Otherwise the work was executed substantially as first planned.

ACKNOWLEDGMENT.

The general plan and location of the plant were first conceived by the superintendent of Water Works, Mr. George I. Bailey, and the successful execution is largely due to his efforts. The members of the water board, and especially the construction committee, have followed the work in detail closely and personally, and their interest and support have been essential factors in the results accomplished. In the designs and specifications for the pure-water conduit the author is greatly indebted to Mr. Emil Kuichling, and also for most valuable suggestions relative to the performance of this part of the work. To Mr. William Wheeler, of Boston, the author is indebted for advice upon the vaulting and cross-sections of the walls, and these matters were submitted to him before the plans were put in final shape. All the architectural designs have been supplied by Mr. A. W. Fuller, of Albany. Mr. W. B. Fuller, as resident engineer, has been in direct charge of the work, and its success is largely due to his interest in it and the close attention which he and the assistant engineers have given it.

DISCUSSION* BY MR. GEORGE I. BAILEY SUPERINTENDENT, ALBANY WATER WORKS.

OPERATION.

Two filters were put in service July 27, 1899. Four more were started July 28. All of these ran until August 9, and three of them continued until August 12. They were started with the hope of continuing, but the conditions were unfavorable in that the water was pumped direct to the filters, as the sedimentation basin was not ready for use; the court between the filters, in which scraped sand was to be de-

*Abstracted by the editor from a discussion in Proceedings American Society of Civil Engineers, February, 1900.

posited, washed and stored, was neither leveled nor paved; and the water in the river was roiled and disturbed by the contractors' operations, and particularly with the wash-water from the sand being prepared for the remaining two filters. The run of the filters was, therefore, stopped and not again commenced until September 5, since which time their operation has been continuous.

Cost of Operation.

The work was organized as follows:—

Filter operation:

10 laborers, at ... ...$1.50 per day.
1 foreman, at .... $2.75 per day.
1 watchman, at ....$1.50 per day.
1 chemist, at ....$1,000.00 per year.

Pumping Station:

3 engineers, at ... ...75.00 per month.
3 firemen, at ... ...$60.00 per month.

The working day is eight hours for laborers, engineers and firemen, and overtime is paid for at the rates named. Occasionally, extra help has been hired, and paid for at these rates.

The gross cost of operation, including pay roll, tools which are still in use, repairs, supplies of all kinds, wash-water, etc., for the period from September 5 to December 25, inclusive, 118 days, was $6,164.94. In this time 1,470,000,000 gallons were filtered, making an average of $4.19 per million gallons delivered from the filters.

The master mechanic of the works gives the following statement from his records, as the daily cost at the pumping station:—

3 engineers ....at	$2.48	$7.44
3 firemen .... "	1.98	5.94
3 tons coal .... "	2.72	8.16
1 laborer ..... "	1.50	1.50
9 gallons engine oil .... "	0.09	0.81
2 gallons cylinder oil .... "	0.11	0.22
5 gallons kerosene oil .... "	0.10	0.50
5 lbs. waste .... "	0.07	0.35
Steam packing, sheet rubber, soap, soda, mops, cloths, etc		6.58
Total $31.50		

This makes the average cost of pumping $2.52 per million gallons received from the filters, and leaves $1.67 as the cost of operating the filters, including laboratory work. The cost of scraping, wheeling out, washing and replacing sand for the actual number of hours, and exclusive of superintendence, laboratory work, lost time, tools, etc., is $1.19 per million gallons treated.

Cleaning the Filters.

The filters have been cleaned 26 times in all, up to December 25, or a little more than three times each. The total amount of sand treated, as measured when replaced, was 850 cubic yards. From the books of the foreman, the following records are taken:—

Scraping.—88,452 sq. yds. = 18.3 acres; time, 1,227 hours = 67 hours per acre.

Wheeling out Scraped Sand.—23,180 barrows, 2,235 hours, 27.3 barrows per cubic yard = 0.38 cu. yd. per hour. The average length of wheel, going and coming, was 600 feet = 1.18 miles per man per hour.

Washing.—18,262 barrows, 2,068 hours, 21.5 barrows per cubic yard = 0.41 cu. yd. per hour.

The volume of water for washing the sand varied from 12 to 14 times the volume of sand washed. In the cost of operation the volume has been estimated at 15 times that of the sand, at a cost of $0.04 per thousand gallons.

Refilling.—18,550 barrows, 1,630 hours, 21.8 barrows per cubic yard = 0.52 cu. yd. per hour. This work was chiefly done by extra labor.

The average depth of scraping was about 3-8 inch, computed from the total quantity of sand replaced and the area scraped.

During the periods covered by these scrapings, the filters yielded 1,212,000,000 gallons, an average of 66,600,000 gallons per acre between scrapings. This includes the first run of the filters, when the unnaturally turbid water already mentioned was pumped directly on the beds.

Color.

The average color of the Hudson River water corresponds to 0.50 to 0.60 on the platinum scale, and about 40 per cent of this color is removed from the water by the filters.

Turbidity.

In periods of freshet the water is very turbid. The highest turbidity reached since the operation of the filter was in December, when the raw water showed 0.60. The effluent then contained 0.008. Generally the raw water runs about 0.035, all of which is removed. The platinum-wire standard is used.

Typhoid Fever.

The reason for building the filters was the sewerage pollution of the Hudson River, and the large death rate from typhoid fever. The average number of deaths from this cause for the nine years ending with 1898 was 85 per annum. During the four months in which the filters have been in operation seven deaths from this cause have been reported. For the corresponding months of the nine years ending with 1898 the average number has been 24. The deaths from this cause have thus been reduced in the ratio of 24 to 7, and one of these seven was in a family which did not use city water.

A History of Water Closets—II.

By Glenn Brown, of Washington, D. C., before the American Institute of Architects.

SOMETIMES latrines were directly adjoining dungeons with drain running to the cesspool (Fig. 13). Sight-seers are frequently shown through these latrines and are informed that the cesspools are dungeons, the agonies which have been endured by prisoners in their depths being graphically depicted by the guides.

Curiously enough, the first mention we have of a water-closet, properly speaking, after the ones used by the Romans, is connected with the publication of a poem by Sir John Harrington on the "Metamorphosis of Ajax" (a close stool or commode), published in 1596. This poem was occasioned, as Henry Harrington reports, by the author having invented a kind of water-closet for his house at Kelson. In the east, water-closets, or what may be called water-closets, seem to have been used at an early date. Ogilby, in a description of the city of Fez, says: "The river Fez subdivides into many clear-running channels through the streets, serving not only each private house, but churches, inns, hospitals and other public places, to their great convenience. Round about the

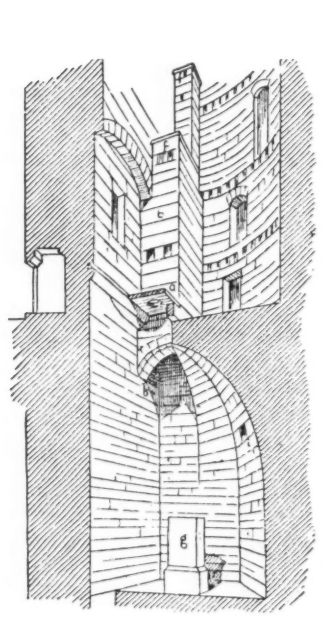


FIG. 12.—PERSPECTIVE SKETCH.

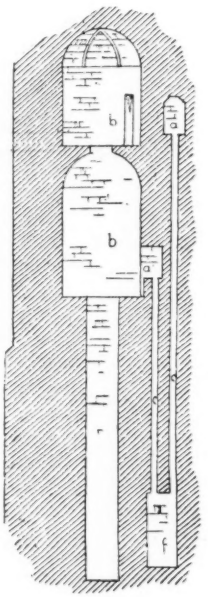


FIG. 13.
a, Latrine. *b*, Dungeon. *c*, Chute or Drain *f*, Cesspool.

mosques are one hundred and fifty common places of ease, built four-square, and divided into single stool-rooms, each furnished with a cock and marble cistern, which scoureth and keepeth all neat and clean, as if these places were intended for some sweeter employment."

Tavernier in his "Relations to the Seraglio," says: "The places for the easing of nature are on the right hand divided into four little rooms, which are always kept very clean, and paved with square pieces of white marble. The Turks do not sit down as we do when we are in those places, but they squat down over the hole, which is not half a foot, or a little more, above the ground. The hole is covered with an iron plate, which rises and falls by a spring, and turning one way or the other, at the falling of the least weight upon it, resumes the station it was in before as soon as the ordure has fallen from it. I have observed

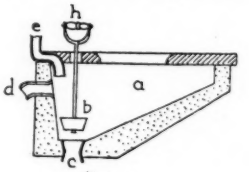


FIG. 14.
a, Bowl. *b*, Plunger. *c*, Waste. *d*, Overflow. *e*, Supply. *h*, Handle.

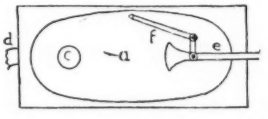


FIG. 15.—PLAN, OR TOP VIEW
a, Bowl. *c*, Waste with plunger removed. *e*, Supply. *f*, Bidet-attachment *d*, Overflow.

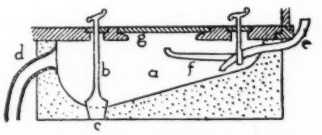


FIG. 16.—LONGITUDINAL SECTION.
a, *c*, *d*, *e*, *f*, Same as Fig. 15. *b*, Plunger. *g*, Seat cover.

that the Turks, and generally all Mohammedans, do not use paper in such cases, or upon any indecent occasion, and when they go to those kind of places they carry along with them a pot of water, to wash themselves withal, and the iron plate is also made clean at the same time, and so the hole being always covered, and the iron plate always kept clean, there can be no ill smell in the place, and that the rather for the small current of water that passes under that place carries away all the ordure. * * * A gallery, which lies to the left hand of the bath, leads to places designed for the easing of nature, and every seat has a cock which supplies them with water to wash themselves after they are done." Baldwin Latham, quoting from Ewbank, would lead us to suppose the above-mentioned cocks were primarily for the purpose of washing the bowl of the closet, if there was one, while it was for the purpose of washing the person using the closet.

We see no mention of water-closets in Europe again until 1770. During the intervening period, while art had professedly entered into a new life, the useful arts seem to have been ignored. In England a close stool or commode, called an ajax, or jakes, was generally used. According to Viollet-le-Duc and other writers, cleanliness, the first principle of sanitation, was thought of very little importance during this period. Privies were used in Germany before they were in France. In Paris people were allowed to throw their excreta from the windows into the street, provided they gave the verbal warning, "Gare 'l eau," three times. In Edinburgh the same custom prevailed; persons walking the streets had necessarily to cry, "Hauld your han," for fear of what might befall them.

The above practice was forbidden in Paris in 1395, but seems to have continued in Edinburgh until 1756. It was

during this period also, that men walking the streets of Edinburgh carrying pails or buckets for the public convenience, and wearing a cloak large enough to envelope their customers and apparatus, crying, "Wha wants me for a bawbee?" The Parisian code of laws improved in 1513 expressly ordered that every house should have a privy, but as late as 1700 A. D., the police were instructed to close all houses whose occupants did not provide one within a month. During the reign of Louis XIV. of France the courtiers found it necessary to ease themselves in the halls of the palace Versailles because there were neither privies nor water-closets. Viollet-le-Duc tells us that close stools were used in the palace of Versailles in the eighteenth century. He also writes of an old lady belonging to the court of Louis XV. of France, who passed the halls of St. Cloud with him when a young man. The odor of an offensive vessel caused her to exclaim with pleasure, "This smell recalls the good old times." Some of our modern closets would have delighted the old lady.

Privies were not used in Spain until about 1770, and have not been used in Warsaw more than fifty years. As late as 1846 we find in Berlin "small closets located on the landing of the stairs, which required to be emptied every other night, to the no great satisfaction of the olfactory nerves." Aubrey, writing in 1718, describes a water-closet which he had seen. He says: "Here (at Sir Francis Carew's, Beddington, Surrey), I saw a pretty machine to cleanse an 'house of office,' viz.: by a small stream of water, no bigger than one's finger, which ran into an engine made like a bit of fire shovel, which hung upon its center of gravity, so that when it was full a considerable body of water fell down with some force and washed away the filth." This must have been much like the closet seen in the city of Fez by Ogilby.

S. S. Hellyer gives a cut of a water-closet taken from Osterly House, which he considers a type of the closets used in England one hundred to one hundred and fifty years ago. Describing it he says; "A niche in a fair-sized room was formed to receive the marble closet-pan (bowl), and a door shutting up close to the seat hid the whole arrangement from sight. A lead soil-pipe was connected

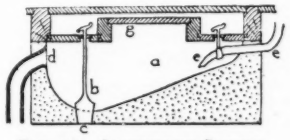


FIG. 18.—SECTION OF CLOSET.
Without bidet attachment, and different arrangement of seat. *a*, *c*, *d*, *e*, *f*, Same as Fig. 17. *b*, Plunger. *g*, Seat cover.

FIG. 17.—CROSS-SECTION.
a, Bowl. *c*, Waste with plunger removed. *e*, Supply. *f*, Bidet-attachment. *d*, Overflow.

with the outlet plug (plunger) waste of the pan, and continued from it to the drain, which was brought into the house to receive it. The soil-pipe had no ventilation." (Fig. 14.)

A. J. Roubo describes a water-closet, and also gives several views to illustrate the subject in the great French book on joiners' work (L'Art Menuisier), published in 1770. We think these are the earliest illustrations of a water-closet extant. The bowl is cut from a single block of stone, all the inside lines being curves so it will not retain the filth as readily, and be easier to clean than if it were in another shape. The lead supply pipe has T-shaped handles and a nozzle spread into the form of a fan, which is evidently for spreading the water over a larger surface of the bowl than would be the case if the nozzle was of the same shape as the pipe. The above-mentioned closet is one of the simplest forms of plunger-closets, and if we are determined to use a closet of this class, then the simpler style would be better and more cleanly than those which

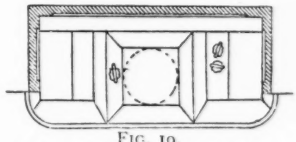


FIG. 19.
View of seat showing mitres and joints

have concealed and foul compartments in which the plunger works, and of which only experts have cognizance. In this closet we see a branch from the supply pipe which could have been used only as a bidet-attachment. This has a hinge-joint so it can be folded back under the seat when not in use. The wood-work is carefully mitred, being tongued and grooved wherever it is advantageous, as is shown by the details. A lid covers the seat, and is made to fit as nearly air-tight as possible when it is closed. The closet described was called "a closet with a plug." (Lieux desoupapes), and it was in use in France a long time before it was in England, as the author informs us.

The first English patent for a water-closet was issued in 1775 A. D., to Alexander Cummings, a watch maker in Bond street. This closet has a sliding valve, or slider, as it is called, between the trap and bowl, and is the only patent issued with a horizontal sliding valve. The title

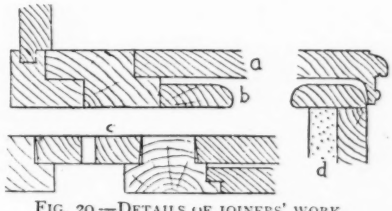


FIG. 20.—DETAILS OF JOINERS' WORK.
a, Cover. *b*, Seat. *d* Bowl (stone). *c*, Opening for plunger and cock handles.

being "a water-closet upon a new construction," proves the use—we might say the common use—of water-closets during and before this time, but of a different pattern from Cummings' closet. Here we find the first recorded instance of a siphon trap being used under and in connection with a water-closet, although we have evidence of siphons having been used in the time of the Egyptians. Below are quoted a few extracts from Cummings' specifications: "The advantages of the said water-closet depend upon the shape of the pan or bason (bowl), the manner of admitting water into it (near the bottom), and on having the stink-trap hitherto used for water-closets so constructed that its contents shall or may be totally emptied every time the closet is used. . . . The sink trap hitherto used for water is too well known to require a description here; and

although it may serve effectually to cut off all communication of smell from the drains, pipe and cesspool, it becomes in itself a magazine of fetid matter, which emits an offensive smell every time it is disturbed by using the closet. In this water-closet the pipe which carries off the soil and water is recurved about twelve or eighteen inches below the pan or bason (bowl), so as constantly to retain a quantity of water sufficient to cut off all communication of smell from below, and this stagnated water in the recurved part of the pipe is totally emptied and succeeded by fresh every time the pan or basin is emptied. . . . The horizontal sections are circular, or nearly so." The mechanism

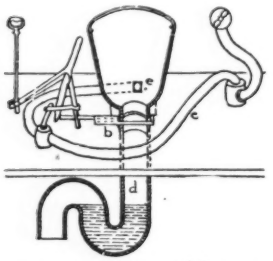


FIG. 21.—CUMMINGS' CLOSET.
a, Bowl. *b*, Slider, or valve. *d*, Siphon-trap.

is very clearly shown in the drawing which accompanies the specification. If the siphon-trap fulfills the duties specified, and we think it does, why complicate matters with the "slider"?

The next patent was issued in 1777 to Samuel Prosser, a plumber living in the parish of Martin-in-the-fields, for a plunger-closet with a double ball cock for shutting off the water when it had risen to a certain height in the bowl, and for turning on the water supply when it had fallen below a definite point. Here we see, for the first time, the (as we consider it) pernicious practice of placing the plunger and ball cocks in compartments separated from the bowl, as far as the sight can penetrate, but connected as far as the deposits from the water and filth are concerned. This closet is described in the specifications as "a water-closet upon an entirely new construction, which will always

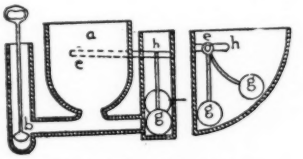


FIG. 22,—PROSSER'S CLOSET.
a, Bowl. *b*, Plunger. *h*, Chamber for ball cock. *g*, Balls for cock. *e*, Supply.

remain free from any offensive smell." We, at the present time, know too well the folly of such claims. Wherever concealed chambers exist connected directly with the bowl, there filth and decayed matter will accumulate, and will become not only offensive to our olfactory nerves, but hurtful to our health. The excreta, in finely divided particles, in this and all similar cases, has free access to compartments that can never be cleaned without the assistance of an expert mechanic.

Essential Features of House Drainage.

By Rudolph Hering C. E.

IT IS quite objectionable to ventilate any trap or fixture into chimneys, under the supposition that there will always be an upcast in the same. In summer there is generally a downcast in certain chimneys protected from the heat of the sun, in which case the sewer air would enter the room.

Before leaving the subject of traps a few of the principal styles should be mentioned. In a perfect system of house drainage, all traps should have a depth of seal in proportion to their liability to siphonage, a question which can be determined in each case, and varies from 1½ to 3 inches. Among all the many styles of traps, those consisting merely of a bent pipe, and having the same water section at every point, are the best, for they permit the quickest flow and the least possible retention of matter. At the same time they are the most readily siphoned and should have separate ventilation in almost every case. The desire to prevent siphonage has brought about many devices more or less complicated. I shall only refer to a few of the most common.

The so-called D trap and the bottle trap are objectionable on account of offering a good chance for deposit. The latter has the advantage, however, that it is hard to siphon when kept clean. When given a rounded bottom it is less apt to store deposit.

Bower's trap, where a floating rubber ball serves to close tightly against the receiving pipe, is a better device, but it also needs occasional cleaning. Its resistance against siphonage is not complete, and it requires ventilation where exposed to considerable suction.

Cudell's trap operates on a similar principle, but a metal ball is used instead of a rubber one. It is more readily siphoned than Bower's trap.

A better anti-siphonage device, however, is Nicholson's trap, as it effectually maintains the seal, by means of a small quantity of mercury, even after all the water has been sucked away. Its expense is unfortunately too great to allow of an extensive application.

The Bell trap used for yard sinks is one of the most common, but also one of the worst, contrivances in use. It readily fills with deposit, maintains, as best, a shallow seal, which in summer evaporates and in winter freezes up. When it is cleaned by removing the bell, the seal moreover is completely broken. A deep trap should always be used in preference.

To recapitulate, I consider the siphon trap, viz., the S, P, and running traps decidedly to be the best under all cir-

cumstances, provided they are properly vented. Without ventilation, Bower's trap is good where only a slight tendency exists to siphonage and Nicholson's mercury trap where there is a strong tendency.

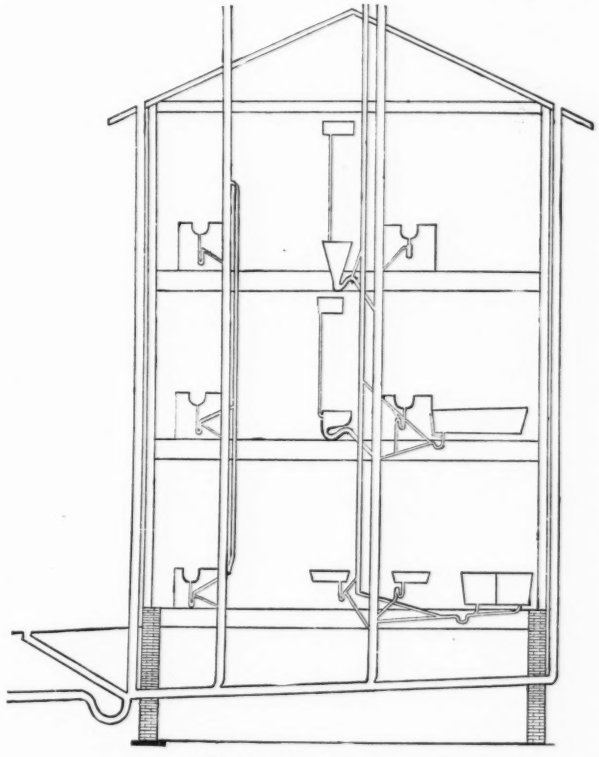
III.—Discharge Pipes.—We have now considered the principal and necessary features, first, of all the receptacles for sewage, and then of the traps which protect them from the back flow of sewer air. The next question refers to the proper arrangement of the pipes which receive and carry away from the premises all the discharges of the receptacles, after they have passed the traps.

These pipes necessarily contain more foul air and foul matter than the fixtures, and any fault in the arrangement or in the execution is likely to be fraught with more dangerous consequences.

In the first place, it is therefore advisable to maintain as much simplicity as possible, and therefore to have as few pipes as is consistent with safety. The receptacles on each floor should be concentrated at one or a few points, and be placed directly over each other in different floors, so that horizontal pipes running between or across the floor beams are avoided. The comparatively small size of the pipes necessary in a building requires them to have a very good grade if they are to work satisfactorily, and this cannot be given them in the small space between the floor boards and ceiling laths.

Usually, it suffices to have one soil-pipe for a building, and one or two waste-pipes connecting the wash-basins, bath-tubs, etc. In England, the common practice is to run the soil-pipes down on the outside of the house, as they are considered more dangerous than common waste-pipes, which are kept inside. In the older countries of the continent, however, the soil-pipe is also inside in order to be protected against the action of frost. In our climate, we are likewise obliged to keep all pipes except rain-leaders inside of the walls. We also do not hold the English idea that waste-pipes from wash-basins, bath-tubs, etc., should not discharge into the soil-pipes, for we say that if the waste-pipes are well jointed and trapped against the escape of any interior air, which may be just as dangerous as the air in the soil-pipe when the bath and laundry water from a diseased person enters them, then there is no reason for any distinction. Waste pipes should have exactly the same treatment as soil pipes. All vertical pipes descending from the receptacles terminate in the main drain, which extends from the furtherest pipe to the point of discharge or outfall. They should be placed on the inside of the wall of the house, and if they are boxed, it should be done in such a manner as to permit ready examination when necessary. The main drain is likewise best placed where it can be seen and where any defects can at once be discovered. It should therefore be run along the cellar wall and suspended or supported by brackets. If carried under the cellar floor, it should lie in a brick or stone trough, closed, with removable covers, to permit examination.

The main requirements of discharge pipes are that they carry away the waste matter as thoroughly as possible, without a cessation of flow or eddy, and that they are thoroughly ventilated. To accomplish this end we must first inquire into their proper size. When water having matter in suspension half fills a pipe, it will be evident to every one that its momentum or force to carry such matter along is greater than when the stream is comparatively shallow and meanders along the bottom of the pipe. Therefore, the latter must not be larger than necessary, for if it is, the stream becomes shallow, it cannot keep the pipes as well flushed, and deposits will occur and accumulate. The foulness of an innumerable quantity of house drains and street sewers is due mainly to the oversight of this important fact.



A Type for House Drainage.

The quantity of water used in an ordinary house, and which is often supplied by a service pipe only one inch in diameter, even when concentrated by the flush of a water closet or tank, and augmented by the roof water from a heavy rain, cannot more than fill a four-inch pipe laid at a good grade. It has therefore been urged that no greater size should be used. Many houses, especially in our country, have been supplied within the last few years with no larger main drains. While the above theoretical reasoning is quite correct, and while it is true that with proper strainers and with a water closet trap only three inches in diameter no substances ought to enter a four-inch pipe that would not pass through it, experience proves that practically four-inch main drains do become stopped up in a greater proportion than ought reasonably to be expected. No doubt in cases where the main pipes have a very good descent, say 1 in 5, where they get a regular cleansing from closets having a large tank flush, and where all the receptacles are carefully used and for no other purpose than that for which they are intended, it may never happen that a four-inch pipe fails a single time.

But to establish this size for all buildings of a town must result, to say the least, in much inconvenience.

It is said that a trouble occurring on one's own premises is clearly due to one's negligence, and the penalty is placed where it belongs. The obstructing matter is prevented from reaching a street sewer, where it might possibly cause an injury to many. This argument is apparently good. But if we look upon sewers and drains as being placed in streets and houses for the purpose of offering the greatest possible convenience to householders consistent with a fair operation of the whole system; if we find in practice that a slinght increase in size to five or six inches gives a far greater immunity against stoppages, without increasing those in the main drains, then we must be compelled to acknowledge that the rigid theory should be modified in practice. In England, long experience has decided against such small main house drains. In Germany, it is considered unwise to reduce the pipes less than six inches. My own experience has also convinced me that for a city in general, main drains should not be limited to less than five or six inches. For ordinary dwelling houses, if the pipes are laid evenly and the joints are carefully made, they need not be over five inches; if any sticks, bottles, forks or other long articles ever get into the pipe through any of the traps or strainers, they are much less apt to get stuck than in a four-inch pipe. The question is, of course, very little affected by so trifling a difference in size, and the house owners, as a rule, prefer to pay for still larger sizes, thinking they will be more efficient.

The vertical soil-pipes need never exceed four inches in diameter, except in very high buildings. Soil-pipes draining as many as six closets have been even successfully used with a diameter of only three inches. Waste pipes should generally be from 1¼to 2 inches diameter; those from a single wash basin should be 1¼ inches in diameter; from baths, kitchen sinks and wash tubs, 1½ inches; from slop sinks 1¾ inches; smaller pipes should never be used.

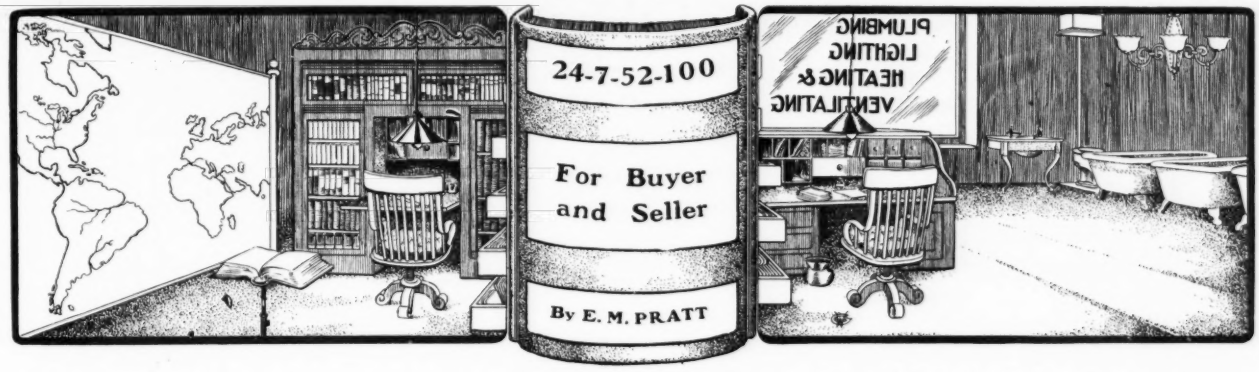
The second important consideration in designing the system of house pipes is to give them an alignment so that the water entering them will meet with no serious obstructions. For this purpose all pipes should be as nearly straight as possible. The vertical pipes should enter those lying nearly horizontal by means of a bend which turns the stream gradually into the latter and prevents the resistance and deposits caused by the sudden check of flow. Pipes that are nearly horizontal can, however, deliver into vertical pipes just as freely without a bend. Offsets should be avoided, as they obstruct the passage of both water and air.

The grade of the pipes should always be as great and as uniform as possible. The velocity of the sewage produced by it ought to be at least two feet per second if the pipes are to be self-cleansing. Generally, however, it is desirable to give the grades a minimum pitch of one foot in fifty feet.

A third consideration is the securing of a free flow of air through all the pipes, not only to follow every sudden flush of water flowing down them and to clear the way before it, so that no traps may be unsealed, but also to supply them with a continual fresh supply of oxygen for purifying the foul matter which may have adhered to the sides. Among all of the principles to be considered in devising a proper house drainage, this one of ventilation is most frequently ignored. Usually no ventilation whatever is provided for the pipes, and in many cases we find one opening only obtained by carrying the pipe above the roof. A little reflection would show that to establish a current of air in a pipe two openings must be given, one for the air to enter and one for it to escape, and to the neglect of this, no doubt, much of the trouble arising from the escape of sewer air into the rooms is due.

All authorities agree on this point, and insist on the discharge pipes being open both at the top and at the bottom for the above reasons. The pipes must, for this purpose, be extended a few feet above the roof. They should not be covered with any cap or cowl, except perhaps a wire basket, where leaves or sticks might get into the pipe, because all such obstructions only impair the ingress or egress of air, with out doing any good. A better current can always be produced in them by increasing the diameter above the roof, and this is to be recommended principally for all the smaller waste pipes, as the friction of air is comparatively much greater in them.

The bottom of the house pipe—i. e., the lower end of the system, should also be opened, and as there is an occasional expulsion of drain air from it, be located away from the windows. These lower openings are called fresh-air inlets, because most of the time they supply air to satisfy an upward current in the warmer pipes. In cities they should be placed at the curb line and covered with a grating. The constant circulation of fresh air through the house pipes keeps them comparatively clean and the air expelled occasionally is not found offensive.



Let the big book of drawers full of envelopes represent the medium between you and me. Imagine that the drawers slide both ways and that the envelopes are alphabetically indexed on both sides. My work is to go into all the world to collect better personal, professional and commercial methods useful to you in your work during the day, the week, the year, the century. This page is for the exchange of questions, answers and experiences.

COMING to Chicago in 1893 for a few months' study of organizations I met a man who liked the looks of my "Business" handbook. He invited me to remain and try applying the ideas I had written down. Taking the non-de-plume "Paul Point," I began working on how to reach and talk to the people to their benefit and your profit. This work grew into another department called

THE PAUL POINT PLAN.

Many ask questions; few think.
Good tell-its may be poor do-its.
Don't be in a hurry, don't get tired.
Some kinds of charity lead to pauperism.
Too many commands dull the ear-drums.
Men love to race brains as well as horses.
Some men are tugs; some men are tanks.
Save a little and it is easier to save more.
A warm-hearted wording helps to sell goods.
Advertising is the fly wheel of the corn sheller.
Don't judge all humanity by any one person.
Win the heart and the eye will read agate type.
Some successful people are greatly surprised over it.
Anticipate changed conditions of supply and demand.
To disbelieve in advertising is like criticising axioms.

Here are some sample paragraphs from the products of it:

The best things in this world are indirect products of hard work.

One pound of hairsprings made from $3 a ton iron ore is worth 17½ pounds of pure gold.

Do not wait until you see the proof before telling the printer how you wish your job set.

It is not worth while to scowl at inanimate things, and it is not wise to scowl at the animate.

A knowledge of mediums, methods and human emotions is necessary to get advertising returns.

Some become rich without the help of advertising, and some go across the Atlantic in twenty-foot sailboats.

A good deal of money is wasted for advertising in order to overcome the effect of unfulfilled promises and poor workmanship.

The word "advertising" means to turn to. It is a turning or convincing process. It is mental muscle in black and white.

One column will do more for an advertiser with a good reputation than two columns will for an advertiser with a poor reputation.

Fourteen kinds of trouble may be caused by not securing necessary information.

Success requires but very little knowledge provided it is just exactly the right kind.

The finest baseball bat ever made is only a stick as long as it is on the ground. Your cleverest ads will not get results unless they are in the proper medium.

Be sure you possess brain bone. All reformers are stoned until they succeed. It requires a lot of brain bone to start out a new and advanced line of advertising.

Also True of Firms—Many a young man owes his advancement to his conscientious habit of preparing himself during odd moments for the duties of a higher position.

The first thing to get a coat of ice is a stagnant pool. It is as difficult to freeze running water as it is to close up a store that uses good fresh advertising copy every day.

Fifty years ago the heaviest cannon used in our government service weighed only five tons and discharged a sixty-eight-pound ball. It was big in those days, but it would not do now.

The advertiser who relies at all times and under all circumstances on a single plan of battle will ultimately meet a most inglorious defeat. Principles are eternal, plans are ephemeral.

Whatever adds to the health tends directly to increase the happiness of the human race. When all advertisers break away from the fake schemes and supply articles worth buying they will wonder why they ever invested money in dishonest offers.

It is not lack of common sense, but lack of determination and persistency. I do not believe any man can succeed in business unless he has complete control of himself; he must master his common sense—his temper, his judgment, his passions—and not permit himself to be carried away by things visionary; he must be self-reliant.

Ad sense is the cream of common sense and the strength of horse sense and the culmination of commercial sense. Any one in any line of practical work, whether it's in the financial world or professional field, to have success must possess a certain amount of ad sense. Business people, advertisers, teachers and students are able to profit by the basic principles of ad sense research.

The Talking Member Indulges in Satire.

CAN see by your face that you want to be told the news," was the opening remark the talking member addressed to the sanitary expert, during a morning call. "Don't deny it and add another sin to the many charged against you. Your face shows that you have curiosity to a large degree. The average man is curious. It accounts for the farmer's stopping work to watch passing teams, and the city man's stopping to look into a hole being dug by another. You can read some faces and others you can't. The man with the inscrutable face is what stumps me. His demeanor is calm, cold and dignified. You search his face to fathom his thoughts. He will appear preoccupied and will answer questions in monosyllables until you will say to yourself, 'Here is a very wise man or a great fool.' As wise men are scarce and fools plentiful you may find your man with only enough wisdom to hide the fact of his being a fool.

"But I will first relieve your curiosity as to news; then I will continue the question of the wise and foolish. I met little Jackson lately in Des Moines and he told me he wanted me to know he was getting three square meals a day. Why he imagined I thought any different I don't know. But as he impressed it on me I suppose he gets them. I am sure I am glad he does. I also hope they are plentiful and nutritious, for a man with Jackson's energy needs good nutritious food.

"He told me as well that he was selling three thousand dollars' worth of goods a week, or a day, and if he is selling three thousand dollars a day or a week he needs three square meals a day with a lunch.

"If he worked for me I would see he got, in addition to the meals and lunch, a beer as well.

King Cole is selling incandescent electric lights. He marches into a shop and holding aloft the light he says, "Behold the statue of liberty!" When Lattimer traveled Iowa he used to say that Cole could not tell the truth. Cole used to retort that Lattimer was the one who could not do so. A question put to the trade about it would be met with "Yes! that's so." Cole came to Chicago once and passed himself off as a dealer from Mason City in want of three steam heaters. He was wined and dined until the graft gave out; then he skipped the town.

Kirkwood lately made a draft on L. M. Rumsey Co. for a new order book. The draft was honored and with it came the following: "Dear Mr. Kirkwood—We have this day met your draft for a new order book, but some of the firm are curious to know what you have done with the one you had. Kindly advise."

J. E. Holland is a pop. It's a boy.

Kuehns & Manning are a new firm in Omaha. They are a product of John Rowe & Co.

Here are some figures of a job of heating and plumbing on a library building at Lincoln, Neb.:

Korsmeyer Plumbing & Heating Co.	$4,836.00
L. W. Pomerene	4,735.00
Peoria Heating Co.	5,210.00

The above included the plumbing for steam only.

J. J. Heminghen	$3,752.00
J. C. Bixby	4,082.00
Estimate on plumbing about	700.00

A close lot of bids as bids go. Heminghen got the contract. Heminghen's present address is Westport, County Mayo, Ireland. When a traveling man said to him before starting, "Bring back the blarney stone," he was told it was not needed. Who did he mean anyway? He has another fat job, Fort Crook this time.

But to get back to the wise and unwise. You are not over wise nor are you very foolish; just an every day sort of an idiot. You are wise enough to set yourself up as an expert in sanitary laws and too foolish to become one. You have been wise enough to make the public believe you are an expert plumber, when the facts are that you could not hold down a job as a journeyman. It is said you learned all you know about plumbing by soldering tin roofs. You are cute enough to hire good mechanics, which is the only thing that saves you. It is your necessity that compels you to; your inclination is to hire cheap men. Don't you know a fool in a business like plumbing is on the border lands of criminality? Don't you know that he is the most important man on the building? Don't you know that the health of the people who will occupy the house depends on his honesty?

Your anxiety to get the contract given you lately caused you to get over the border and into the land of crime. Your saying you could cheapen the work by using vitrified pipe in lieu of cast iron for the house sewer was the act of a criminal. Your saying you had a good, careful man to lay it did not justify you one bit. A good, careful man? Ole, to lay the sewer! intelligent Ole! He knows how to dig a ditch. You know Ole can dig the trench but the bottom will be a long way from level. Then he will give the sewer the proper grade by blocking it up with pieces of brick or clods of clay. He will then put some cement around the joint that will be absolutely of no use. Then to cap it all he will fill in the trench, tamp it down, knocking the pipe off the bricks, crushing the clod of clay and knocking the grade galley west. These facts will not be found out until it stops up or some innocent meets death from it, and you will be responsible for that death. Don't you know that if that kind of pipe could be made tight the gas companies would use it for mains?

Expert! Sending the most ignorant men to do the most important work. Say, you don't know sewer gas from the smell of Dutch cheese. You don't know a microbe from a brindle cow. You have no patent on the claim you have set up. Experts like you fill the world and you are poor specimens. Some day a real one will come along and you will be a two spot. You will be an expert who has been pried loose from his job, for the law of the

survival of the fittest will be in force, and you are not fit, only a misfit.

I see a way for another expert to work a similar graft. He could put out the sign: Heating and Ventilating Engineer. He could tell when a house was cold; he could tell when a house was hot; he could tell when it was neither hot nor cold. He could tell when a crack at a window let in wind. He would not be able to tell wherefore. His workman could attend to that. He would be an expert and would not have to. He would only have to talk about the carrying capacity of pipes, the heating capacity of radiators, the relative cooling capacity of glass and walls, grate areas, flue surfaces, combustion chambers, the efficiency of grate over flue surfaces, chimney impulses, how every human being requires thirty cubic feet of atmospheric air to live properly (and some don't even with the full allowance and are always trying to raise more wind).

He could design a steam and water heater, for he certainly could make as good a one as the foundryman who stacks up cast iron and calls it a heater. He would not have to know what is necessary to make an efficient one. He could make the water travel long and hard of way so it could acquire the right amount of friction and caloric as it worked its passage to the top. Arms and points could be put on at all angles, making the water climb up and then down. These points and arms would have an equal value to an extra curl on a pig's tail. It would be a good talking point. The smoke in its passage through the flues would be compelled to deposit the soot in them. Of course the sensible thing would be to burn it, but he would not be sensible; he would be an expert.

For each square foot of grate surface he could have two square inches of flue surface, so that when it did not work the chimney could be blamed.

When he had got all these things done he would have acquired a reputation. Why such as you don't reach out and get hold of some real knowledge is strange. Some day there will be a man who will be a real expert come along and—and—

But what's the use
Of killing a goose
That lays a golden egg?

The Welsbach Light.

THE Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, acting through its Committee on Science and the Arts, investigating the merits of the Welsbach Light, which was referred to the Committee by the Jury of Awards of the late National Export Exposition, 1899, reports as follows:

The procuring of artificial light by some means other than using the flame of burning carbonaceous material in the ordinary candle, lamp or gas burner, has been the aim of many investigators. As a result of this endeavor, we find on the one hand lamps in which carbon is heated to a point where it gives off light—or becomes incandescent—as by the passage of an electric current through an incandescent filament or arc lamp crater; or, on the other hand, lamps in which the incandescence of certain substances (oxides of certain of the elements for the most part) is produced by the application of a heating flame or the passage of an electric current to raise their temperature. Of these latter burners, the development of those using a heating flame applied to produce incandescence of rare earths is the particular thing dealt with in this report, but it seems impossible to avoid a mention of others when giving an outline of the chain of discoveries and inventions leading up to the Welsbach light of to-day.

It is probable that Drummond is one of the earliest discoverers of the fact that heated oxides of certain elements incandesce. Certainly he made the first practical application of the fact. Every one knows of the Drummond or lime light which has been so commonly used in the projection lantern. A piece of lime, or better, a piece of oxide of magnesium, or, most refractory of all, a piece of oxide of zirconium, has an oxyhydrogen flame play upon it and is thereby heated to a temperature at which it incandesces and gives off an intensely-bright white light. Lieutenant Thomas Drummond, in the English government service, made this discovery in 1826, and used it in connection with his heliostat in surveying work, and afterwards proposed the same arrangement for lighthouse service.

In 1868, Le Roux, Professor at Ecole Polytechnique, Paris, discovered that a brilliant incandescent light might be procured from a rod of lime or magnesia, by heating it until an electric current passes, this afterward maintaining the light.

In 1879, Jablochkoff patented the use of a piece of kaolin as a source of light, making it incandesce by passing an electric current through it. He had noticed that the kaolin he had placed between the carbons of his arc lamp assisted the illumination.

These inventions show something of the development of knowledge regarding materials which might be made incandescent, and the means taken to make them incandesce.

Several years later, in 1881, W. M. Jackson (an American) invented the device of a lamp made of platinum, iridium or other materials non-oxidizable at high temperatures, in the form of wires of small section which were heated to incandescence by the use of a heating flame. He discovered that the finer his wires the more intense the light produced. Here is a beginning of a mantle light.

In 1881, Charles M. Lungren, of New York, patented in the U. S. Patent Office an improvement in illuminating apparatus, which consisted in passing a non-luminous gas flame through a heater of clay or similar material highly heated by jets of the non-luminous gas, and forcing atmospheric air through the heater and causing it to mingle with

the non-luminous gas issuing in one or more jet flames against lime, magnesia, zirconia or similar material, producing incandescence.

In the same year (1881) Mr. Lungren filed an application in the Patent Office for a means of illumination which consisted in forming a filamentary body of refractory material, said body having the structural form necessary to envelope a gas flame and to be rendered incandescent by such flame.

This application, after allowance by the Patent Office, was permitted to lapse, and no patent was then issued.

Mr. Lungren, however, renewed his application in August, 1885, and the patent, which embodied improvements upon his unissued patent of 1881, was issued July 5, 1887 (No. 365,832). Subsequently, a second patent (No. 367,534), describing specific features of his incandescent lighting method, was issued to Lungren under date of August 2, 1887.

In the first of these patents Lungren describes his method of making refractory filaments for lighting composed of "lime, magnesia, zirconia, etc.," by preparing a plastic mass of these materials, or mixtures of them by kneading them with water, or preferably, a solution of a mucilaginous binding material, such as glue or gum, or other combustible material which will be consumed in the further treatment of the filament. When the mass is of the proper consistence it is put in a press and the filament is obtained by expressing the material through a die. Immediately after their formation, and while still moist, the filaments are formed up into various shapes desired by bending or coiling over a mandrel of wood coated with plumbago, or other device, and then dried, when they are ready to apply to a support and to be used in connection with a gas flame, in substantially the same manner as the well-known Welsbach mantle.

The Lungren incandescent lighting system was the subject of investigation by the Committee on Science and the Arts of the Franklin Institute in 1891. Prolonged practical tests of the Lungren filaments showed that they possessed unusual life duration in service, with satisfactory lighting quality, and the award of the John Scott Legacy Premium and Medal was made to the inventor.

For reasons unknown to your committee this promising invention was never commercially exploited.

The next year (1882) a Frenchman, Charles Clamond, invented a lime light operated without oxyhydrogen flame by intensely heating the air used and directing the flame of his air and gas mixture against the refractory oxide chosen. He knew of the possible use of certain other metallic oxides to produce an incandescent light, and even invented a basket or mantle of magnesia threads, supported in an enclosing platinum mantle of small wire and large mesh, which was hung below the lamp and the heating flame directed down into it. The threads were made from magnesia which was calcined and pulverized, then made plastic by mixing with salts of magnesia, which may be afterwards decomposed by heat, then squirted through a die, woven into a basket form and dried and baked.

In 1885, Otto B. Fahnehjelm, a Swedish inventor, secured an American patent (see U. S. Patent No. 312,452, February 17, 1885) for an incandescent light which consisted in the combination with a suitable gas burner and a shade holder of means for suspending an incandescent body in the flame of the burner, and for adjusting the incandescing body horizontally and vertically in relation to the flame. The Fahnehjelm light consisted substantially of a series of rods of calcined magnesia, resembling the teeth of a comb, held in a suitable frame and suspended in a non-luminous flame of gas.

In 1886, Galopin and Evans (in Australia) produced a lamp burning hydrocarbon vapor mixed with air to produce a heating flame, directed downwards into a woven platinum mantle, which was thus made incandescent.

About this same time, or even a little earlier (1885), Carl Auer von Welsbach announced the invention of a lamp in which the rare oxides of lanthanum, yttrium, zirconium, etc., in a finely divided condition, were rendered incandescent by heating to a high temperature. The source of light was a light network of cotton thread impregnated with a solution of the salts of the combined nitrates, oxides or bromides. After being saturated with these, upon exposure to heat, the supporting cotton network was burned out, the salts converted into the oxides and a skeleton hood or cap thus prepared, which would incandesce when a heating flame was applied to it.

The absolute originality of this form of mantle and method of manufacture should be carefully noted.

The nitrates of the metals, being very soluble, were especially adapted to the process, although sulphates, iodides or bromides could also be used.

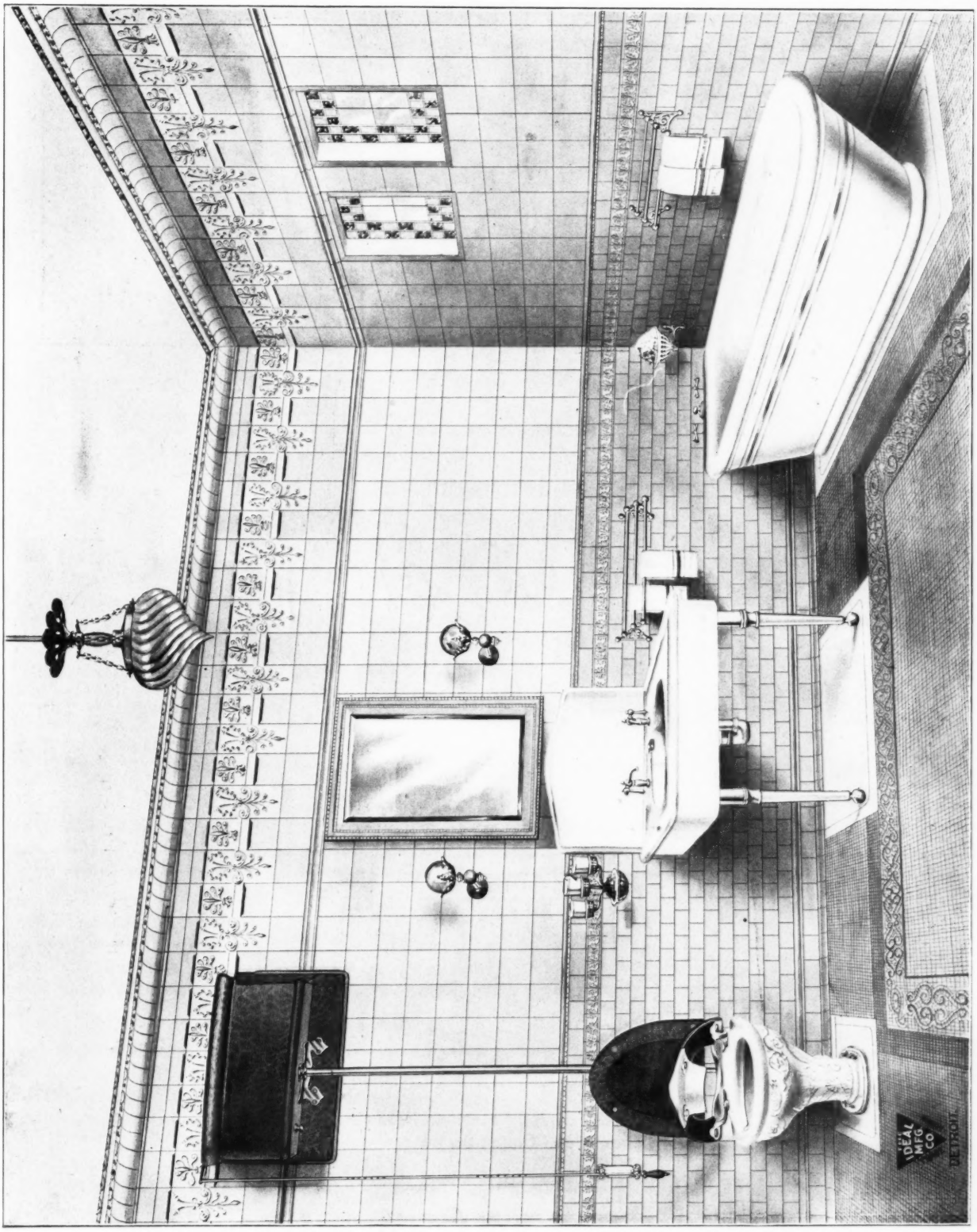
Welsbach found that this mantle, as it came to be called almost from the first, could resist the action of all atmospheric air fit to breathe for an indefinite length of time, was not changed by exposure and would remain effective for a long time.

For the next five years or more von Welsbach was constantly at work making elaborate investigation of the properties of all oxides of metals which would incandesce when used separately, and when combined in various mixtures. He invented processes whereby the salts of the metals required for impregnating mantles might be prepared from the natural ores, originated means for strengthening the frail mantle, arranged the mantles for transportation in safety, and perfected many details making the lamp practical.

It is interesting to notice that the form of mantle and the general process of manufacture have remained up to the present precisely as von Welsbach originally planned them, without improvements or essential modification of any kind.

One or two of the discoveries of von Welsbach are necessarily mentioned a little in detail, to explain the magnitude of the investigations he conducted and the sort of results he procured.

A patent No. 409,531, August 20, 1889, explains that the illuminating power is greatly increased by adding thorium oxide; that lanthanum oxide without sufficient thorium oxide crumbles when incandescent—with it the mantle becomes flexible. Later he found (patent No. 563,524) that thorium oxide, by the addition of a small per cent of uranium or cerium oxide, has a very high illuminating power, producing a vivid and nearly white



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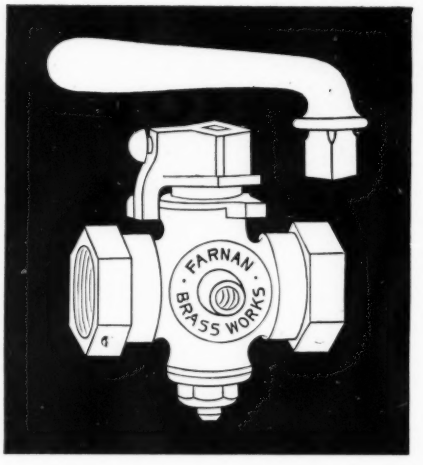

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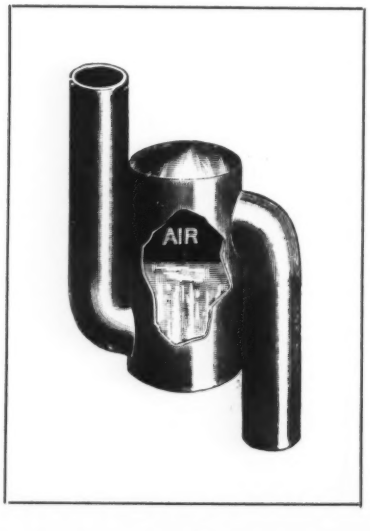

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incandescent light, in spite of the fact that thorium oxide alone radiates little light which is yellow in color, and that uranium oxide alone radiates little light, and it is yellow reddish. Still later, he discovered that the illuminating power of lanthanum, cerium, yttrium, zirconium and other metals of the refractory earths is greatly increased by the addition of thorium oxide (ThO_2); that cerium not only gives a yellow light (very desirable color), but greatly increases the life of the mantle, causes it to hold its shape better, and makes it in every way stronger and more durable.

Thus we get a slight idea of the elaborate researches conducted by Dr. von Welsbach, and of the many difficulties which had to be overcome before the Welsbach mantle could become practical and commercial.

To complete the story of lights procured by the incandescence of metallic oxides, mention should be made of the lamp invented by Prof. Walther Nernst, of the University of Gottingen, early in 1899, the substance rendered incandescent being a magnesia rod through which an electric current is passed after preliminary heating. Not only is this light related to the same group as the Welsbach, not only does it give a very modern illustration of a sort of lamp mentioned earlier in the report, but (most interesting of all) in his latest work Nernst gives up the magnesia and uses the same mixtures of oxides as used in the Welsbach mantle—zirconium, thorium, cerium, erbium, etc.

A very brief description of the lamp and mantle made for use with illuminating gas by the Welsbach Light Company, of Gloucester, N. J., will give the best idea of present methods, and serve to bring out some important points with reference to the light-giving power, durability and economy of the mantle as put on the American market. The Welsbach "J" mantles (standard until very recently) were made about as follows: A six-cord cotton thread was woven on a knitting machine forming a tube of knitted fabric of rather open mesh. This web has the grease and dirt thoroughly washed out of it, is dried, then cut into lengths double that required for a single mantle. It is then saturated in the fluid (described later), wrung out, stretched over spools and dried. Next the double length pieces are cut into two, the tops of each piece doubled back and sewed with a platinum wire which draws the top in and provides a means of supporting the mantle when finished from the wire holder. After stretching the mantle over a form, smoothing it down and fastening the platinum wire to the wire mantle holder, the mantle is burned out by touching a Bunsen burner to the top. The cotton burns off slowly, leaving a skeleton mantle of metallic oxides, which are unconsumed, and which preserve the exact shape and detail of every cotton fiber. The soft oxides are then hardened by a Bunsen flame. During burning out and hardening considerable shrinking takes place. This finishes the process, except the immersion of the mantle in crystalline, to prepare it for transportation, after which it is trimmed and packed. The fluid in which the cotton webbing is immersed is procured from monazite sand, which yields in the finished mantle oxides of thorium and cerium.

The candle-power of mantles of the sort mentioned is about 75 initial candle-power under gas pressure of Philadelphia illuminating gas. This means 20 candles per cubic foot per hour (an ordinary 8-foot fish tail burner gives not over 3 candle-power per cubic foot per hour). The life of the mantles is probably not much below 1,000 hours. The candle-power drops quite rapidly at first and more gradually afterwards, going as low as to one-half the initial candle-power before the mantle breaks.

It is hard to tell how much the perfection of detail in burner construction, a proper selection of chimney, and artistic features of design have contributed to procure the very large commercial use of the lamps. Without proper burners the mantle would be of small value. The details of the common burner, the peculiarities of which make it different from the ordinary Bunsen burner in adjustment of gas and air; the gauge distributing device to spread the flame over the whole mantle and so fill the mantle are too well known to merit detailed description.

The mantle first made in America, in 1888, gave only 35-40 candle-power initial, under 10|10 pressure, using 3 to 3.2 feet of gas on 3-inch mantles, and under ordinary conditions not over 8 candle-power per cubic foot of gas used.

The new mantle, known as Balm Hill or, popularly, "Yusea" mantle, has a much more open mesh than the "J" mantle, and is made on lace-making machinery. It is thus supposed to be much stronger than the older mantle, and gives about 100 initial candle-power at the mantle when the gas and air are properly adjusted in the burner. Your committee has been unable to gather data of life or decline in candle-power in time to include them in this report.

Certain defects in the mantle light should not be entirely passed over. The mantle is exceedingly fragile and cannot be made to stand where it is subject to continued vibration; the quality of the light is such as to require the adjectives cold, ghastly, harsh, in describing it; and often a greenish tinge in the light is evident. The candle-power drops badly early in the life of a mantle, and is especially subject to this trouble where there is much dust in the air; the oxides seem to volatilize slowly from the mantles, as evidenced by the shrinking in size of strands of mantle and the white deposit on chimney, for platinum melts easily in the part of the flame where the mantles hang.

If the mantle breaks, a hole being thus produced in it, the hot flame strikes out through this, often breaking the chimney and as a secondary result destroying the mantle itself.

On the other hand, the advantages in the use of the mantle for lighting are shown not only by statements already made, but also by the fact that artificial lighting has been profoundly affected by the commercially-successful mantle. We have systems of lighting using mantles now in which the source of the heating flame is gas, gasoline, kerosene. There are systems using Welsbach mantles in which pressure of large amount, and others in which low pressure is used. There are two great companies, the Welsbach Commercial Company and the Welsbach Street Lighting Company, that do an enormous business and deal

only with the use of the Welsbach mantle in lamps using ordinary illuminating gas.

The patents held in this country by the Welsbach Light Company are very broad and fundamental, and have to do with all sorts of details of the system as well. Over fifty in all were submitted to your committee. Some of these are not to Welsbach, and yet are for processes of importance in the manufacture of the present American-made mantle and lamp.

In consideration of the enormous advance in the art of artificial lighting made possible by the invention of the Welsbach mantle, the Franklin Institute awards the Elliott Cresson Medal to Dr. Carl Auer von Welsbach, of Vienna, Austria, for his discoveries regarding the metallic oxides which may become incandescent when heated, and for the invention of a mantle by the use of which these metallic oxides are commercially available as sources of artificial light.

Also, in view of the many details wrought out by the Welsbach Light Company, of Gloucester, N. J., in putting a thoroughly practical mantle on the market, the Franklin Institute awards to them, the said company, in addition, the Edward Longstreth Medal of Merit.

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, June 6, 1900.

JOHN BIRKINBINE, President.
WM. H. WAHL, Secretary.

Countersigned by
H. R. HEYL,
Chairman of the Committee on Science and the Arts.

Some Sanitary Aspects of House Construction.

Read before the Congress of the Sanitary Institute at Glasgow, by Wm. Wallace, Ph. D., F. R. S. E.

LAST winter I read a paper on building stones to the members of the architectural section of the philosophical society, and the subject attracted a good deal of attention among the architects and builders in the city; especially as it had a direct bearing on the selection of a stone suitable for the erection of the magnificent pile of buildings about to begin by the corporation of Glasgow. An opinion was also expressed that the chemist might give valuable information, and make useful suggestions to the architect and builder if he would devote his attention to the construction of buildings. The encouragement received on that occasion has induced me to bring before the architectural section of the sanitary institute a short paper on some of the sanitary aspects of house construction, excluding entirely from consideration the important subjects of drainage and sewerage, which I leave to others who have made them a special study.

Granting, then, that a house is well drained, and that the plumbing is properly trapped and ventilated, what is wanted to make it a healthy residence is that it should have plenty of light, and that it should contain at all times air pure and dry, or at least as pure and as dry as may be possible. The subject of light may be dismissed in a few words. The importance of having larger windows is perfectly understood, and so far as isolated buildings are concerned it is unnecessary to say anything. But as regards street architecture, it is of the utmost importance that houses should be built of a height bearing a direct relation to the breadth of the street in which they are situated; hence the paramount importance of having enacted by parliament rigid building regulations for cities and towns, in order to prevent the erection of tenements of such a height in proportion to the breadth of the street that the windows in the lower stories get little or no sunlight. This is a subject which has been thoroughly discussed in this and other cities, and I hope that in course of time more stringent rules than we at present possess will be enacted. A fair proportion in this latitude is that the house should not exceed in height two-thirds of the breadth of the street; thus giving three stories in height for a street of forty-five to fifty feet wide, and four stories for one of sixty to seventy feet. I say, advisedly, in this latitude; for while at the equator the sun at mid-day is perpendicular or nearly so, in high latitudes it forms with the earth's surface an angle more or less acute. Hence a street in Cairo of only fifteen or twenty feet wide may be better lighted than one of forty or fifty feet in Stockholm. As regards the direction of a street, I should prefer to live in one placed as nearly as possible north and south; in this case, and taking the west side of the street as an example, the sun shines from morning till mid-day in the front, and from mid-day till evening in the back of the house. But in a street running east and west, the houses on the south side get scarcely any direct sunlight—in winter none at all—in front; while those on the north side are equally unfortunate as regards the back rooms. No apartment can, in my opinion, be considered a perfectly wholesome one which does not enjoy direct sunlight during some part of the day. But, if an apartment must be so situated that it cannot have sunlight, it is some compensation that it have very large windows, so that it may get as much diffused daylight as possible.

Purity of air cannot be maintained in a house unless it be thoroughly dry. Setting aside the not inconsiderable quantity of water produced by our own breathing and by the combustion of gas, oil, and candles, the air in a house is liable to be rendered unwholesome from excess of moisture, first, by absorption of water from the rock or soil below, and, second, from the porous stone of which the building is constructed. Not only is the air loaded with moisture from these sources, but it is rendered impure from the exhalations of fungous vegetation, or dry rot, which, at the same time destroys the joists and other carpenter work, and seriously affects the stability of the house. It is a mistake to suppose, as many do, that dry-rot attacks

only the wood in the basement story. It is a common occurrence for the ends of joists built into porous stone to become affected by fungous vegetation; and it is frequently seen in pulling down old tenements that the ends of the joists are quite gone, and that, probably, for many years the joists have been resting only on the plaster cornices of the rooms. The remedy is the use of "shoes" of glazed fire clay or other material, which are built into the wall, and into which the ends of the joists are placed. The "shoes" should be somewhat larger than the joists, which should be kept in position by little wedges of wood, so that air can play freely around the end of the joists. Such protected joists will last for hundreds of years, if other circumstances are favorable.

The porosity of most varieties of building stone is remarkable. In the paper to which I have already referred I have given, besides other properties, the quantity of water capable of being absorbed by the stone when air-dried. By weight it ranges from 3.4 per cent in the celebrated Craigleigh stone to 7.2 per cent in the red sandstone found at Wemyrs bay, on the Firth of Clyde. The significance of this property of porosity is still more readily appreciated if we take the amount of water absorbed by bulk instead of weight. One hundred parts by measure of the hardest and best freestone take up about eight parts of water, and the inferior kind twelve to fifteen parts. A cubic foot of the stone will therefore absorb from five to nine pounds of water, or from half a gallon to nine-tenths of a gallon. The absorption of water by certain kinds of stone is so rapid that in slight showers of rain the whole of the water is imbibed; and, although a greater part of this evaporates afterwards from the surface of the stone, a portion must always find its way inward, and this is especially the case when the surface of the stone is kept constantly wet by continued rain.

Another property of freestone is its power of permitting the passage of air or other gas by transpiration and diffusion. A cube of stone varnished over on four sides and enclosed at the other two in an air-tight case provided with inlet and outlet tubes, permits the passage of coal gas to such an extent that the gas can be lighted and will continue to burn, even although the pressure is not more than an inch of water. The same thing applies to other building stones which we, more or less, possess, and to bricks, unless they have been exposed to a temperature high enough to flux the material of which they are made. The quantity of air diffused into it and out of a house by the walls must be very considerable, and as it is a process that is constantly going on, it must necessarily exercise an appreciable influence in maintainining the purity of the air in dwelling houses. If, however, the brick is saturated with water, the porosity, for the time being, destroyed; or if there is any air diffused at all it will be loaded with watery vapor, and therefore of less value, in a sanitary point of view, than it would be with only its normal proportion of moisture. Besides this evil, there is the more serious one of the water actually reaching the joists and other wood, such as "dorks" and wall plates and straps, and causing these to decay, and so interfere with the stability of the structure. Coating the stone with oil, paint, silicate or soda solution, or other means of rendering it impervious to water, prevents the absorption of rain; but it also, at the same time, destroys the valuable property of diffusing pure air into, and impure air out of the house. The only way that I know of for securing the advantages of the porosity of the stone and preventing the injurious action to which I have referred is to have double walls, with a space of a few inches between, into which air is freely admitted by openings in the wall at top and bottom, placed in such a manner that rain will not enter by them or lodge in them. The openings may be about three inches square, and placed about six feet apart, and they should be sloped upwards for the reason I have just stated. The inner wall may be of brick, either four and one-half or nine inches thick, according to the height of the building, and it should be tied into the outer wall by pieces of thick iron wire with angled ends. The system of building with concrete blocks pursued in Sandown, Ventnor, and other places in the Isle of Wight, is well adapted for constructing walls on the principle I have indicated. The blocks of concrete are about eighteen inches wide by twelve, and are of two thicknesses, those for the outer wall being four or five inches, and for the inner about three or three and a half inches in thickness, and these are tied together by pieces of iron wire, with a space of about three inches beween them. This forms what looks to those accustomed to the two-feet thick solid walls of Scottish houses, a very flimsy wall, but it appears to be sufficiently strong for a building of two stories in height, and with a few openings above and below for the admission of air into the space between the outer and inner walls it would form a structure which, in a sanitary point of view, would be perfect, although I would prefer to have the inner wall of brick, which is more porous than the blocks of concrete, formed of fine gravel and cement, which are used in the Isle of Wight.

It is a common observation that, in spite of every care being taken in the construction of a building, the joints of the stone are often imperfect and admit water freely, especially when the rain is accompanied, as it often is, by high wind, especially when the wind comes from the southwest. To prevent the rain penetrating, it is customary in some districts to build, not on a flat bed, but one sloping slightly upwards. This is a system highly to be commended; and if it be objected to on the ground of giving less stability to the building than working upon a perfectly level bed, this objection might be overcome by making the greater part of the bed level, with about two inches of the stone on the exterior side of the wall slightly bevelled.

In the case of rubble walls the best that can be done, probably, is to point them with a mixture of Portland cement, with twice its bulk of sand, taking care that the sand is not too fine; and then to whitewash the entire walls with Portland cement, a process which may be repeated with advantage. But the pointing should not be done until the walls have had a summer's sun and are practically dry; otherwise the greater part of the water in the walls will evaporate inwards, that is, into the house, and so keep the atmosphere damp for a longer time than is actually necessary. A two feet wall will not dry thoroughly, however, even under the most favorable circumstances, in less than two years.

As regards the interior of houses, plaster, whether on brick or lath, is exceedingly porous, and permits of a ready diffusion of gases; and a wall merely whitewashed or colored with distemper is better in a sanitary point of view than one that is covered with oil paint, which becomes by this process practically impervious to the passage of gases. Wall papers are probably not so bad in this respect as oil paint, but are certainly inferior to distemper or whitewash.

The foundation of a house and the basement are the most important parts of it as regards its sanitary condition. The most perfect foundation upon which a house can be built is a solid platform of concrete, extending over the entire area of the building, and from two to three feet in thickness, according to the height of the walls, and coated over on the top with nearly pure cement. No damp could penetrate this mass; but I would not, even in this case, lay the sleeper joists upon the concrete, but would place them at a sufficient height to obtain ventilation of the space below the floor. In case of accident, arising from the bursting of water pipes, or other causes, I would make the concrete with a slight upward slope towards the center of the area, so that the water could run away freely through the ventilating gratings. This would be a somewhat expensive foundation, but I think it would be a most satisfactory one. Another system which would probably prove equally good is to build the foundation walls and dwarf walls up to a certain level, fill in the interior spaces with broken material to the same level, and cover the whole surface with a layer of Portland cement with two parts coarse and three inches thick. Another system still is to place a damp course of slate, or slatey stone, bedded in Portland cement, on the whole of the walls; fill up the whole foundation to the same level with broken material, and cover this, but not the walls, with asphalt. This makes excellent foundation, but the filling in is generally omitted, the architect being content with a damp course on the walls just below the sleeper joists, and leveling the interior space and asphalting. In this way I have seen very serious evil resulting from the absorption of water from the soil by the portion of the walls below the damp course, then giving off sufficient watery vapor to keep the space below the floor quite damp and to introduce dry-rot to a most alarming extent. It is not an uncommon practice to neglect the precaution of putting a damp course on dwarf walls, in which case dry-rot is almost certain to occur unless there is profuse ventilation. In such a case the joists should be laid not in a wall-plate of wood, but upon roofing slates placed below each joist, but it is better to place along the top of the dwarf walls a complete anti-damp course of roofing slates bedded in cement, and upon this to lay a wall plate in the usual manner.

With regard to the ventilation of the space below the basement floor, it is a safe rule to have gratings all around the building, if it is a detached house, not more than ten feet apart; but if it is a street where ventilation can be obtained only in front and back, the gratings should be not more than five or six feet apart, and should be of ample size, say ten inches by six. In order to facilitate the free circulation of air, the dwarf walls and partition walls should have numerous and large openings. It may be objected to that such ample ventilation as I have indicated would make a cold basement story; but the simple remedy is to put ashes, with or wihout lime, below the floor, in the same way that deafening is applied to the upper floors.

In a wet climate, such as ours, in which it is not an uncommon occurrence to have half an inch of rain falling in a single day, it is a proper thing to cover the chimney-tops in order to prevent rain from coming down and keeping the gable walls to some extent constantly damp, and it is a good thing to combine with the cover a means of preventing down-draught in the chimneys during high winds. The cover which I recommend is one having a flat top with a section of a cane below, the whole chimney top and cover being constructed of galvanized iron. The chimney is ten inches diameter at the bottom, and eight inches at the top, the cover is twelve inches diameter, and the space between the top of the chimney and the cover is four inches. The cover is supported on three iron rods, and is fixed by nuts in the top, which are easily removed when the chimney is to be swept. All chimneys should be lined with fire-brick cylinders very carefully jointed, otherwise a great deal of watery vapor from the combination of the coal will find its way into the gable walls, and there may be trouble also from smoke. A chimney from a gas stove, unless kept open below, is certain to give trouble from the condensation of water. Every cubic foot of coal gas gives by com-

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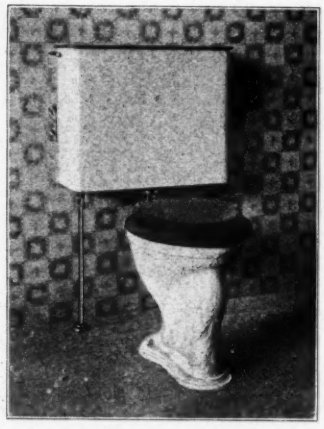

bustion about an ounce of water, and as gas stoves consume from ten to thirty cubic feet per hour, a very large quantity of water is produced. In ordinary coal fires the large proportion of heat wasted up the chimney prevents any considerable condensation of water unless when a fire is just lighted, but in the case of gas stoves the heat passing up the chimney is comparatively small, and is probably never sufficient to prevent entirely the condensation of water.

In the brief sketch I have taken up only one branch of my subject, and I do not propose to deal with others, such as the ventilation of dwelling houses and public buildings; but I shall merely notice, in conclusion, an exceedingly simple means of ventilating apartments, which I have found to give excellent results. It is to put in every window in a house a series of perpendicular holes, one inch in diameter, in the lower frame of the top sash of the windows. The holes may vary in number from three to six, according to the breadth of the window, and I may say that I have never found it necessary, even during the prevalence of the highest wind, or during the coldest weather to close any of these orifices.

I fear I owe an humble apology to the architects who are members of this congress for going beyond my own profession and invading theirs, but I trust that my remarks may be accepted in the same spirit in which they have been given. I have endeavored to put together a few hints founded on my own observation and experience; and if some of my ideas are not new, as I can well believe, they may not be the worse for being enforced by repetition.

Death of James Ragan.

The District of Columbia sustained the loss of one of its most highly esteemed citizens in the death of Mr. James Ragan, which occurred on the morning of December 24th, at his residence, 642 E street northeast, Washington. The deceased was in the sixty-second year of his age, and had enjoyed general good health until last spring, when he suffered from quite a severe illness. He apparently recovered, however, and seemed to be in execellent condition up to about three weeks ago, when he began to complain. He was out attending to business as late as last Wednesday. The demise was caused by Bright's disease.

Mr. Ragan was born in Georgetown, and resided in the District ever since. Prior to a quarter of a century ago he served for many years as chief engineer of the Capitol, and superintended the installation of the heating and plumbing systems throughout the building. He resigned his position at the Capitol about twenty-five years ago to engage in business on his own account as a master plumber. Only a few days ago he completed a contract for remodeling the plumbing at the Capitol.

For several terms Mr. Ragan held office as president of the Master Plumbers' Association of the District of Columbia, and was a member of the board that formed the plumbing regulations now in force here. He has also served as a member of a board to examine applicants for license as master plumber.

Death of James Robertson.

James Robertson, founder and president of the James Robertson Manufacturing Company, of Baltimore City, died at Montreal, Canada, December 18, 1900, aged 68 years.

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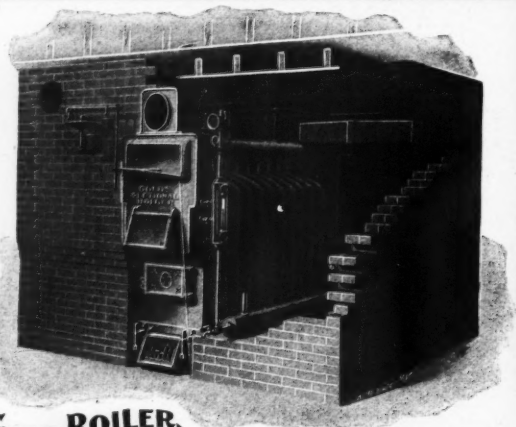

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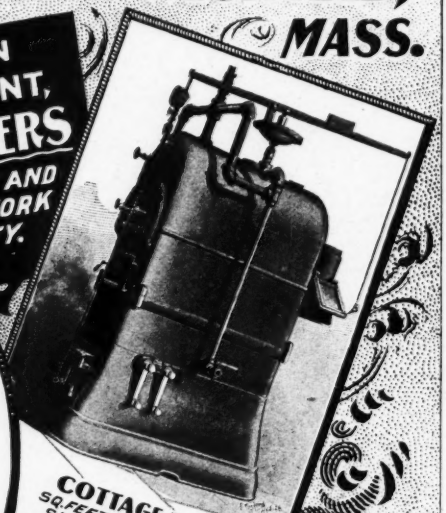

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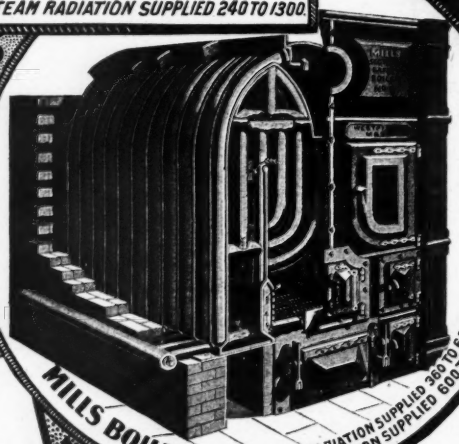

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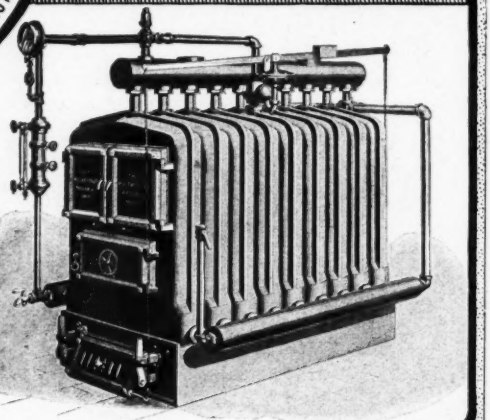

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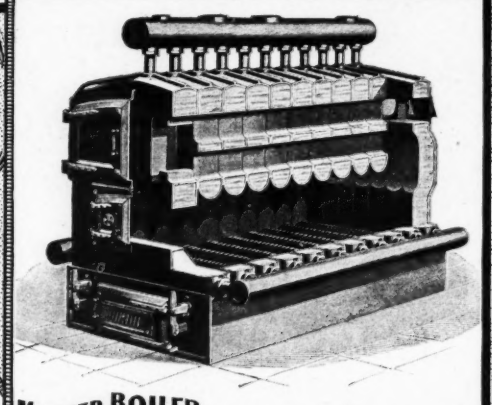

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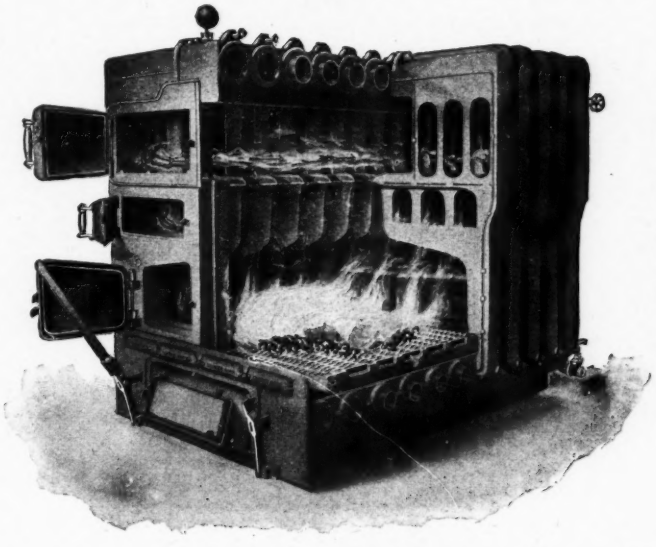
Measuring the Flow of Water from Pipes.

ONE sometimes requires to know the output of a centrifugal pump or of a pipe of water when no means are at hand for measuring it. A rapid approximation can be made by the following means:

Below the center of the outlet pipe place a horizontal rod at a depth of x feet, or say 4 feet as a convenient depth. Mark off the rod in feet and inches and measure the distance y at which the center of the jet passes the edge of the rod. Now, it is plain that the jet has issued at such a velocity that it has traversed a distance of y feet during the time that the force of gravity has caused it to fall a vertical distance of x feet. The rule for gravity is $x = 16 \times t^2$, where t is the time in seconds. If we make $x = 4$ feet, we have $4 = 16 \times t^2$. Therefore $t^2 = 0.25$ and $t = 0.5$, for $0.5^2 = 0.25$. The water has dropped 4 feet in one-half a second. Obviously, it has traveled y feet horizontally in half a second. Suppose y measures 9 feet. Then the water jet has a velocity 9 feet in half a second, or 18 feet per second; that is 6 yards. But a yard of water from a full round pipe weighs d^2 pounds, where d is the pipe diameter in inches. If our pipe is, say, 5 inches diameter, a yard of water will weigh 25 pounds. Since we have a flow of 6 yards per second this gives us $25 \times 6 = 150$ pounds, equal to 15 imperial, or about 18 American, gallons, or 54,000 imperial gallons per hour. As a rule, there is some contraction of a jet issuing from a short pipe. The contraction is about 0.8. Hence, $54{,}000 \times 0.8 = 43{,}200$ gallons per hour is the prob-

"Capitol Heaters"



The adjoining is an illustration of the "98 Series Capitol," the popular heavy-duty boiler of the day. An investigation would undoubtedly prove of interest to any in the trade not already familiar with this construction. Descriptive catalogue mailed on application.

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able outflow. Put into a formula for gallons per hour, this would work out:

$$G=\frac{384\times y\ d^2}{\sqrt{x}}$$

in which
G = imperial gallons per hour,
d = pipe diameter in inches,
x = hight of middle of pipe above rod,
y = horizontal distance in feet.
If G = United States gallons per hour, the formula would become:

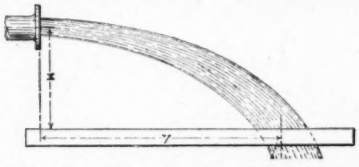
$$G=\frac{466\times y\ d^2}{\sqrt{x}}$$

The method is useful for testing the outflow of an artesian well, when such overflows.

The depth x may be anything one chooses to make it. I have used 4 feet because it is convenient, but it may well be less for smaller jets, and if taken at 1 foot the formula is much simplified in working, for $\sqrt{1}=1$, and the formula becomes simply $384\ y\ d^2 = G$ and $466\ y\ d^2 = G$ for imperial and U. S. gallons respectively. The vertical fall of 1 foot represents of course a quarter second, and the velocity of outflow per second is $y \times 4$. We need not, however, use the formula at all. If we find the velocity of flow per second in yards and simply multiply by d^2, we have the pounds of outflow per second, which we can reduce to any other measure or time as we think fit.

The method is not of much good unless the pipe flows full, so that the outflow is of full circular section.

Where the outflow is vertical, or nearly so, the velocity of outflow may be judged by the hight the jet rises above the orifice. Thus a jet rises 2 feet from a 6-inch pipe. What is the flow in gallons? The space fallen through by a falling body is $S=16t^2$, where t is the time in seconds. Our 2-foot jet rises through a space $=S=2$. Then $S-2 = 16\,t^2$. Therefore $t^2 = 2\text{-}16$, the square root of which is about .35 of one second. Thus the jet has required .35 of a second to travel 2 feet. As the initial velocity is double this mean velocity, the actual outflow rate is obviously



1 foot in .35 of a second, or nearly 180 feet per minute = 60 yards. Now, 60 yards of water measure 216 imperial gallons. The contraction of flow from a long pipe will perhaps reduce this to 200 gallons, or 12,000 gallons per hour.

The rule agrees fairly with observation of an artesian well spouting about 30,000 gallons per hour. The head causing flow was about 10 feet above the pipe top, but the jet only rose 3 to 3½ feet, the well being 170 feet deep. The loss of 6 feet or so was caused by the friction of the long pipe, and the outflow could not have been calculated without recourse to the formula for long pipes, which are more or less doubtful. The direct observation of the velocity of outflow is likely to be more accurate if a pipe is slightly inclined to the vertical, when the hight of jet is easily measured.—American Machinist.

The Air of Buildings and Sewers.

*By J. S. Haldane.**

THE subject of my communication is apparently such a wide one, that I fear that you may consider that any such discussion of it here within reasonable limits cannot fail to be unprofitable. My intention, however, is not to attempt to treat the subject with anything approaching to fullness, but mainly to bring under your notice the results of some experimental researches on vitiated air, recently conducted by Prof. Carnelley, of Dundee, and myself,† and to initiate a discussion by the members of congress on the conclusions to be drawn from these experiments.

The first series of observations refers to the air of buildings. The fact that an enormously increased mortality prevails amongst persons who spend much of their time crowded together in ill-ventilated rooms is universally admitted. It is therefore unnecessary that I should recapitulate here any of the evidence we possess on this subject, or of that which more directly connects an increased mortality with vitiated air.

One of the first requisites for success in the endeavor to procure pure air is a knowledge of the nature and amount of the various impurities presented in vitiated air, and the sources from which they arise. Hitherto, our knowledge of the amounts of these impurities has related almost entirely to the carbonic acid and moisture. Carbonic acid is easy to estimate in the air and its amount is rightly assumed to be a pretty good index of the impurities directly communicated to air by respiration. It is, however, highly im-

*Read at the Bolton Congress of the Sanitary Institute of Great Britain.

†The details of most of the experiments referred to here will be found in a paper by Prof. Carnelley, Dr. Anderson and myself in the Philosophical Transactions of the Royal Society, Vol. 178 (1887), B, and in a further paper by Prof. Carnelley and myself, which will appear in the proceedings of the Royal Society for June 12th, 1887. The results of the experiments in the Bristol sewers are communicated here for the first time.

probable that carbonic acid itself has any appreciable influence on health in the proportions in which it is ordinarily present in vitiated air. And on the other hand it is a mere assumption, and as we shall see an unjustified assumption, that the carbonic acid is anything like a certain measure of the impurities which are directly or indirectly communicated by human beings to air in other ways than by respiration.

Of the other impurities of vitiated air perhaps most interest attaches in view of recent advances in pathology to the micro-organism, and especially to the bacteria. It has lately become possible to estimate the latter with relative ease and accuracy, thanks to methods of research introduced by Prof. Koch and Dr. Hesse. There are still other impurities, some of which we can detect by the sense of smell. We know little as to their chemical composition, and if possible less as to their hygienic significance. They may be roughly set down as "organic matter." They indicate their presence by several chemical reactions, one of these being the bleaching of solutions of permanganate of potash. For the purpose of our research Dr. Carnelley introduced a process dependent on its reaction, by which the relative amounts of the bleaching action in different specimens of air could be rapidly estimated. (Carnelley and Mackie, Proc. Roy. Soc., Vol. 41, page 238.)

Our observations on the air of buildings relate chiefly to dwelling and school houses in Dundee. The main part of our work consisted in making a large number of simultaneous estimations of carbonic acid, "organic matter," and micro-organisms; but we endeavored to throw what light we could on the sources of each constituent.

THE AIR OF DWELLINGS.

The analyses of the air of dwellings were made during the night, between the hours of one and five in the morning, as we considered that at this time the air would contain about an average amount of the impurities existing in the air during the presence of the inhabitants. We examined the air in sleeping rooms of eighteen of the better class of houses in Dundee, in thirteen two-roomed, and in twenty-nine one-roomed dwellings. The results were as follows:

	One-roomed houses.				Two-roomed houses.				Houses of four rooms and upwards			
	No. of Cases	Lowest	Highest	Average	No. of Cases	Lowest	Highest	Average	No. of Cases	Lowest	Highest	Average
Persons per house (per room in last class).	29	2	10	6.6	13	4	10	6.8	8	1	3	1.3
Space per person.	29	104	528	212	13	148	395	249	8	391	4206	1833
Temperature (°F)	21	43	61	55	9	50	59	53.5	3	42	63	54.5
Carbonic acid	29	6.3	32.1	11.2	12	7.1	13.2	9.9	18	4.5	11.7	7.7
Organic matter	29	7.8	38.1	15.7	11	5.0	30.2	10.1	18	1.1	12.0	4.5
Total micro-organisms	28	6.0	240.0	60.0	13	8.0	128.0	46.0	18	0.5	22.0	9.0
Bacteria	19	6.0	120.0	58.0	11	6.0	118.0	43.0	16	0.5	16.0	8.5
Moulds	19	0	5.0	1.2	11	0	10.0	2.2	16	0	1.0	0.4

On each night similar analyses of outside air in the streets were also made for purposes of comparison. If we subtract the amounts found in the air outside from the above quantities, and take the corrected averages of the air of the better class of dwellings as unity, we obtain the following total:

	Houses of four rooms and upwards	Two-roomed houses.	One-roomed houses
Cubic space per person	1	0.13	0.11
Carbonic acid	1	1.5	2.0
Organic matter	1	1.6	4.4
Micro-organisms (total)	1	5.1	6.7
Bacteria	1	5.1	6.9
Moulds	1	5.5	3.0

These tables show clearly the enormous differences in the purity of the air of different classes of dwellings.

Dr. Anderson, medical officer of health for Dundee, with whom we were associated in our work, and who originally suggested it, obtained by special arrangements with the registrars materials which made it possible to construct a table of the mortality statistics of Dundee for 1884, arranged in a similar manner.

Death-rate.	No. of Cases	Whole Population	Per 1000 Living: Houses: 4-roomed and upwards	3-roomed	2-roomed	1-roomed	1 & 2 r'm'd includ. Infirm. & p'rhouse
General death rate	3119	20.7	12.3	17.2	18.8	21.4	23.3
Death-rate of children under 5 years of age	1347	9.0	3.3	5.8	9.8	23.3	10.8
Ditto of all above 5 years of age	1772	11.7	9.0	11.4	9.0	9.1	12.5
Ditto of all above 20 "	1449	9.4	8.2	8.9	7.3	8.5	9.8
Ditto of all above 70 "	293	1.9	2.4	2.1	1.4	1.3	1.4
Ditto of all above 80 "	75	0.5	0.65	0.77	0.39	0.20	0.41
Mean age at death.							
Of all who died	3119	24.5	40.0	30.6	21.3	20.9	23.9
Of all who died above 70 years	298	76.3	76.9	77.2	76.9	74.6	76.0
Of all who died above 20 "	1449	53.6	57.7	54.4	51.6	54.8	52.1
Of all who died below 20 "	1619	2.5	4.5	4.4	2.2	1.8	2.3
Of all who died above 5 "	1732	45.2	51.7	45.5	43.0	48.2	44.1
Of all who died below 5 "	1306	1.1	1.4	1.2	1.1	0.9	1.0
Of all who died between 5 and 20 years	313	9.2	11.7	12.2	8.3	7.0	8.3
Disease causing more than 50 deaths.			Per 10,000 Living.				
A Diarrhœa	253	16.9	6.1	11.3	17.4	26.4	20.2
A Measles	94	6.3	1.3	3.6	7.0	9.1	7.9
A Convulsions	78	5.2	1.7	2.3	6.5	6.7	6.6
A Accidents (including overlaying)	93	6.2	1.7	1.8	3.4	14.6	8.3
A Prem. birth and debility during first days of life	177	11.8	3.0	6.3	13.4	17.0	14.8
A Acute bronchitis and bronchopneumonia	224	14.9	7.8	9.5	13.4	26.7	17.6
A Chronic bronchitis	159	10.6	6.3	9.5	8.1	16.5	11.8
B Croupous pneumonia	155	10.3	3.5	6.6	12.7	9.5	12.5
B Meningitis	122	8.1	5.7	6.8	8.9	6.7	8.9
B Hooping-cough	99	6.5	0.9	6.8	8.4	6.3	7.8
B Tumors	73	4.2	2.2	3.6	4.1	3.1	5.7
B Heart (valvular disease	159	10.6	9.1	9.5	8.4	9.4	11.1
C Phthisis	369	24.6	13.0	27.6	24.4	14.6	26.4
C Apoplexy, thrombosis & embol. of vessels of brain	160	10.7	17.4	5.9	6.9	7.9	9.2
C Diphtheria and croup	93	6.2	7.0	4.1	6.9	3.1	16.5
C Old age	150	10.0	8.7	12.7	5.5	7.5	9.7

I have not time to say anything further here with regard to this table, but I think it has many points of interest of its own quite apart from our experimental results. It shows that not only is the mean age at death on the whole about twice as long in the best as in the worst houses, but that at all periods of life up to old age those who live in the better houses have the advantage.

The fact that the increase in death rate runs parallel with the increase in air-pollution does not prove that the former is the cause of the latter. But we may argue from other evidence that the pollution of the air is one very potent cause, and probably the chief cause of the increased mortality.

THE AIR OF SCHOOLS.

We examined during winter two rooms in each of the board schools and several denominational and private schools in Dundee, besides several lecture-rooms in University College. The rooms examined may be classified

in the first place according to the means of ventilation, as this was found to make an enormous difference in the results. A certain proportion were ventilated by ordinary means, such as fires, open windows, and ventilators in the roof. The rest were ventilated mechanically by blowing air by means of fans over hot pipes, and thence into the several rooms by means of shafts. The table below gives the results obtained with the two kinds of ventilation.

	Schools.							
	Naturally ventilated				Mechanically ventilated			
	No. of cases	Lowest	Highest	Average	Average	Lowest	Highest	No. of cases
Per cent of windows opened	..	..	..	22	3	..	..	..
Number present including staff	39	27	191	92	64	20	170	20
Space per person	39	56	427	168	164	119	228	20
Temperature (°Fahr)	35	44	65	55.06	62	58	69	18
Carbonic acid	39	7.9	37.8	18 6	12.3	7.9	19 6	20
Organic matter	38	5 0	40.3	16.2	10.1	3.4	19.0	20
Total micro-organisms:—	35	8	600	152	16.58	0	58	18
Bacteria	28	8	600	151	16.0	0	56	18
Moulds	28	0	4	1.1	0.58	0	2	18
Or above outside air:—								
Temperature (°Fahr)	25	3	34	16.8	24	22	26	3
Carbonic acid	39	4.4	34.3	15.1	8.9	3.5	16.1	20
Organic matter	38	0	31.4	7.8	1.1	0	5.3	20

Or, if we take as units the average cubic space, the average excess over outside air of temperature, of carbonic acid and of organic matter, and the average micro-organisms, in mechanically ventilated schools, the comparative results for naturally ventilated schools may be expressed as in the following table:

	Mechanically Ventilated.	Naturally Ventilated
Cubic space per person	1	1.0
Temperature in excess of outside air	1	0.66
Carbonic acid " "	1	1.7
Organic matter " "	1	7.0
Micro-organisms " "	1	9.2
Bacteria " "	1	9.4
Moulds " "	1	2.0

We have not included in the above table the Dundee High School, nor the only private school we have examined, as in these two cases the cubic space per person was about three times as great as in the other schools. The results for these two schools were as follows. It will be seen that practically they confirm the conclusions drawn from the results in other schools, though the effects of mechanical ventilation are not nearly so marked:

	Private school (Girls) Naturally ventilated.				Dundee High School (Boys and Girls) Mechanically ventilated.			
	No. rooms ex.	Lowest	Highest	Average	Average	Lowest	Highest	No. rooms ex.
No. present	3	6	11	9	36	13	64	6
Space per person	3	320	528	457	538	320	1102	6
Temperature (°Fahr)	3	56	59	57	57	51.5	60.5	6
Carbonic acid	3	10.7	13.3	11.9	13.0	8.5	16.4	6
Organic matter	3	6.2	11.8	8.9	3.9	1.7	5.6	6
Total micro-organisms	3	4	15	9.3	3.6	1	11	7

We now come to some of the most unexpected and interesting of our results. Wishing to test more thoroughly the results of mechanical ventilation, we made a number of comparative experiments on different days in the same room. The circumstances were as nearly as possible the same, except that on some days the mechanical ventilation was in operation, and on other days not, open windows, etc., being used instead. We found, to our surprise, that whereas the carbonic acid present in the air was increased from 12.6 to 18.6 volumes with the mechanical ventilation not in operation, the average number of micro-organisms remained almost exactly the same. Even when the mechanical ventilation was kept off for a week, this had no distinct effect in increasing the number of micro-organisms. These anomalous results did not lead us to doubt the effects of mechanical ventilation in diminishing the number of micro-organisms in air, as we found the number very small even in rooms where every other condition except the ventilation seemed to favor a large number. We were, therefore, forced to conclude that while the ventilation at the time is the decisive factor in influencing the amount of the gaseous impurities, it is, other things being equal, the habitual state of the ventilation which influences the micro-organisms. This led us to inquire into a number of points regarding the sources of the micro-organisms.

It had previously been proved by Tyndall and others that physical disturbances of any kind, such as those caused by the presence of human beings, have a very great effect in disseminating micro-organisms in air, and that air left perfectly still gradually deposits its micro-organisms. We naturally, at first, expected that varying amounts of physical disturbance would very much obscure other differences. It turned out, however, that this is not the case. Although the influence of difference in physical disturbance is well marked, under ordinary circumstances other influences have a much greater effect, as we shall see.

That the micro-organisms do not come from the breath, but are, on the contrary, filtered off by respiration, we showed by means of some experiments, the details of which need not be described here (see Phil. Trans., Vol. 187, B, page 92). That they do not come in any large number directly from the clothes or skin of the person present in a room was shown by a number of observations made in the two chemical lecture rooms. Even during a course of crowded popular lectures there was found to be an average of only four micro-organisms per litre, as compared with an average of about three when the room had remained empty. Nor did the number rise beyond six per litre when the room was left unventilated during the lecture, and the carbonic acid rose to nearly 40 volumes per 10,000. This observation alone shows strikingly, I think, that the carbonic acid is no measure of the number of micro-organisms in the air of a room.

The micro-organisms thus do not come to any large extent from the bodies of the persons present at the time. Nor do they come from the outside air, which is comparatively free from micro-organisms during winter, as shown both by our own experiments and by the more recent and systematic ones of Dr. Percy Frankland. We must, therefore, conclude that they come from the floor and other parts of the room itself. If this is really so, the state of a room as regards cleanliness ought to have an effect on the num-

ber of micro-organisms. This we found to be actually the case, as shown in the following classification of both schools and houses:

		No. of cases.	Average space per person.	Average carbonic acid.	Average organic matter.	Average micro-organisms.
One-roomed houses	Clean	1	295	8.0	13.1	18
	Dirty	7	200	9.9	18.1	41
	Dirtier	13	221	10.7	13.5	49
	Very dirty	6	220	11.0	15.1	93
Two-roomed houses	Very clean	2	273	12.2	10.8	10
	Clean	4	264	9.3	7.7	32
	Dirty	7	233	9.4	11.2	69
Naturally ventilated Board schools	Cleaner	12	167	19.7	18.1	91
	Aver. cleanliness	12	166	14.2	16.2	125
	Dirtier	12	191	22.5	15.2	198
Mechanically ventilated schools and college	Cleanest	7	194	12.5	12.7	3
	Clean	11	155	12.8	8.3	16
	Less clean	4	152	10.0	8.8	30

We next classified the schools according to age, and obtained the following results:

	No. of cases.	Micro-organisms per litre.
Opened before 1886	7	311
" 1875-1880	20	150
" 1884-1885	5	38

This was not at all what we expected to find. One would rather have anticipated that the micro-organisms, like the ordinary dust particles in a room, would very soon reach a maximum, depending on how often the room is cleaned. But the causes under the action of which a room becomes infested with micro-organisms are evidently no merely temporary ones, but have a gradually cumulative action. Further investigations on this point are now being carried out by Prof. Carnelley at Dundee.

At the time the results of our analysis led us to this important result, we were unaware of a very interesting research made recently by Dr. Emmerich, of Leipzig; I think the results he obtained may throw a great deal of light on this cumulative infection of the air by micro-organisms. At any rate, his research was such an important one that I need not apologize for shortly referring to it.

He made a large number of analyses of the damping material used for filling up the space between the ceiling of one flat and the floor of the flat above. He found an almost incredible pollution of this material. His analyses show that, to use his own words, "there exists nowhere in nature, not even in the neighborhood of human dwellings, a soil so highly contaminated with nitrogenous organic substances and their decomposition products as the damping material under the floor of dwelling rooms." The amount of chloride of sodium found in this material was on an average seven times greater than that found in the ground under leaky cess-pools, and twelve times greater than that in the soil around a dung hill, although this soil was visibly soaked with filth. When the coarse pieces of stone were separated from this material, it was found that the finer dust and sand that was left contained even more nitrogenous matter than human excrement. "In the damping material of a single room, there was usually more excremental matter present than in a large cess-pool." That all this filth is alive with micro-organisms is shown by the amounts of products of decomposition which result from this activity. Thus, under the floor of one single room, Emmerich found that there were more than 6 cwt. of nitric acid in the form of nitrates. He also showed that the carbonic acid in the air of rooms left shut up and empty increased, although other known sources of carbonic acid, such as subsoil air, etc., were excluded. The chief cause of this contamination was undoubtedly the soaking of fluids and shaking of dust through the fissures and spaces between the boards in the floors. Often, however, the rubbish which was used as damping material was contaminated from the beginning, having been taken from old houses, or rubbish heaps, such apparently as many houses in this country are built upon.

Emmerich's paper is such a remarkable one, and contains so many points of interest, that one is surprised at not having heard something of it in this country. It is well worth the careful attention of every one interested in questions of public health. There seems no reason to doubt that a very similar state of pollution exists in the damping material of English houses.

Emmerich followed up this research by another no less interesting one in connection with the same subject. In a prison at Amberg there had persistently occurred for years epidemics of croupous pneumonia. The last of these had attacked every seventh, and killed every twentieth, prisoner. As is well known, the late Dr. Friedlander, of Berlin, discovered the presence in cases of croupous pneumonia of a species of bacterium, cultivations of which, when inhaled by, or inoculated into certain animals, produces a similar disease in them. There can thus be little doubt as to the casual connection between this organism and the disease, or at any rate certain forms of it. Emmerich examined the damping material from the infected rooms in the Amberg prison. He not only found this material full of organic matter as usual, but actually discovered Friedlander's bacterium in enormous numbers.

To return to our own researches, it seems very likely that the progressive contamination of the material in the floors, and perhaps elsewhere about the room, may be connected with the progressive contamination of the air with micro-organisms. Emmerich's researches throw a vivid light on the manner in which this progressive contamination may affect the health of the inhabitants. A glance at our table of statistics will show how the mortality from croupous pneumonia, for instance, increases from 3.5 per thousand in the better houses to 6.6 in three-roomed, and 12.5 in one and two-roomed. Probably the mortality would be even larger in the latter class were it not for the influence of hospital treatment, which is very frequently taken advantage of in cases of croupous pneumonia, and is of great benefit.

In what manner exactly mechanical ventilation reduces the number of micro-organisms in the air seems still rather obscure. The explanation may perhaps lie in the more

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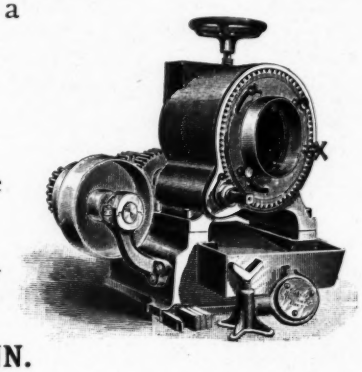

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efficient sweeping out with the air of the particles of suspended organic matter which would otherwise have formed a pabulum for the growth of micro-organisms. Or perhaps the growth of the latter may be prevented by the greater dryness of the rooms mechanically ventilated.

Let me refer to one or two further points before leaving the subject of school ventilation. We classified the schools according to the cubic space per child at the time of our visit. It will be seen that increased cubic space up to 300 cubic feet brought with it no diminution in the pollution of the air. With mechanical ventilation, on the other hand, there was a diminution, at any rate in the number of micro-organisms, with increase of cubic space.

Cubic space per person	Naturally ventilated				Mechanically ventilated			
	No. of cases.	Carbonic acid	Organic matter.	Total micro-organisms.	No. of cases.	Carbonic acid	Organic acid.	Total micro-organisms.
Cubic feet								
50—100	6	21.5	16.2	119				
100—150	14	15.5	19.6	128	7	14.0	7.8	23
150—200	5	18.9	12.3	150	8	11.4	9.6	14
200—250	9	21.	16.8	188	5	11.8	12.3	10
250—300	4	17.	9.5	187				
300 and upwards	4*	15.	11.8	12	6	13.0	3.6	2

* Three of these were in a private school.

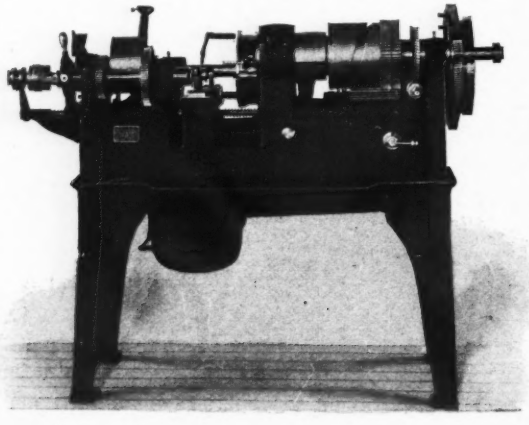
We also divided the naturally ventilated schools we examined into two classes, according as they were heated and ventilated by fires or by hot pipes respectively—and we obtained the following results. The data for mechanically-ventilated schools are added for comparison:

Description of school.	No. of rooms examined.	Carbonic acid	Orgnnic matter.	Total micro-organisms
Ventilating mechanically, and heated by hot air blown into the rooms	20	12 3	10.1	16.5
Heated by fires, and ventilated in the ordinary way	18	16.9	15.7	169.
Heated by hot pipes in the room itself, and ventilated by windows, ventilators in the room, and in some cases by a few small Tobin's Tubes	21	20.0	16 5	92.

The following table shows the results of a comparison of a number of pairs of rooms. The rooms in each pair were as similar as possible in every respect (such as age of children, etc.) except that one was occupied by girls and the other by boys:

	Space per person	Temperature (°Fahr)	Carbonic acid	Organic matter	Micro-organisms
No. of rooms compared	20	20	20	16	30
Boys	275	60	15.0	7.9	92
Girls	382	58	12.3	6.7	65

The general result of our investigations has, I think, revealed a state of matters in schools urgently calling for improvement. The amount of loss of life and health resulting from the vitiated state of air is in all probability enormous. Capt. Douglas Galton dealt with this subject in his admirable inaugural address at the Newcastle congress of this institute. Let me only recall one of the facts mentioned by him,—that the mortality among teachers in elementary schools was found to be about 20 per



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1,000, as compared with 5 per 1,000 in two classes where the average age was presumably about the same—the police and navy—and 3 per 1,000 amongst prisoners.

We can afford to provide abundance of fresh air for criminals, and surely we might do as much for our children. It is not only abundance of ventilation that is required for keeping the air of rooms pure, but the room itself must be prevented from becoming contaminated by dirt. For this, both personal cleanliness is required and the means of keeping the room itself and everything underneath and about it absolutely clean. I do not doubt that engineers and architects can devise not only satisfactory and sufficient methods of ventilating and warming schools, but also floors which will be incapable of becoming polluted in the manner just referred to.

THE AIR OF SEWERS.

The analyses we have made of sewer air refer chiefly to the sewers at Dundee and at Westminster Palace. We used exactly the same methods as had been used for houses. Altogether we examined thirty-two specimens of sewer air at different times and places. The average results obtained at Dundee and Westminster are shown in the following table:

	Total				In excess of outside air at time.			
	Temperature (°Fahr)	Vols. carbonic acid per 10,000 vols. of air	Vols. of oxygen to oxidize the organic matter in 1,000,000 vols. of air.	No. of micro-organisms per litre.	Temperature (°Fahr)	Vols. carbonic acid per 10,000 vols. of air.	Vols. of oxygen to oxidize the organic matter in 1,000,000 vols. of air.	No. of micro-organisms per litre.
April 19th to May 19th, 1886								
In sewers	54°	7 5	7.2	8.9	5.2°	3.8	4.9	—7
Outside air at same time	49	3.7	2.2	15.9				

If we compare these results with those obtained in schools and dwellings, the astonishing difference appears in favor of the sewers. This is brought out more clearly in the following table, in which the average quantity in excess of outside air of each constituent in sewer air is taken as unity:

	Carbonic acid	Organic matter	Micro-organisms
Sewers	1	1	1
Houses { one roomed	1 7	1.3	7x
Houses { two roomed	1.4	0 45	5x
Houses { four rooms and up	0 9	0 3	x
Schools { naturally ventilated	4 0	1 6	17x
Schools { mechanically "	2 3	0 2	2x

Evidently in some respects sewer air is one of the most free from micro-organisms anywhere in a town. It is in this respect twice as pure as outside air, in summer at any rate. This result may perhaps come as a surprise to many people, but is in reality not in the least surprising. Prof. Nageli of Munich showed some years ago that micro-organisms, like other particulate matter, are not given off from moist surfaces. As everything inside a sewer is moist, we should therefore not expect micro-organisms to be given off. That even the motion of water running as in a sewer does not give off anything particulate was also shown by some interesting experiments with lithia solution published by Prof. Frankland in 1877.

We may contrast the obstacles which thus exist to micro-organisms being given off by the sewers, with the absence of such obstacles in the case of accumulations of dirt about or underneath the floor of a room. The latter accumulations are more or less dry, and constantly being shaken, and the air of the floor is usually being sucked up into the room. There are thus all the conditions present for air contamination.

What, now, are the sources of the few micro-organisms actually found to be present in sewer air? Prof. Frankland showed that the bursting of bubbles, disseminated particles of lithia solution, and therefore presumably micro-organisms. We made some laboratory experiments at Dundee, which showed directly how completely Prof. Frankland's inference was justified. But in the sewers we visited there were no bursting bubbles, as the current was far too fast for sufficient putrefaction to take place; it therefore seemed desirable to ascertain whether the micro-organisms had not simply come in by the ventilators from the outside. It was not so easy as might have been supposed to get conclusive evidence on this point; but I think we can show that it is at least exceedingly probable that this was the source of almost all the micro-organisms.

In the first place, if the micro-organisms came from any part of the sewer or its contents, we should expect that the longer the air remained in the sewer, the more would it become charged with micro-organisms. It is usually difficult to discover from direct observation how long in any particular case air has remained in the sewer, but we can judge roughly of this from the amount of carbonic acid present. If we classify the results in three equal divisions, according to the amount of carbonic acid found, we obtain the following table:

Total:—	Temperature	Carbonic acid	organic matter	Micro-organ.
4.8— 6 2 vols. of carbonic acid	55.8°	5.7	5.1	8.7
6.7— 7.9 " " " "	53.1	7.3	6 3	6.4
8.6—10 9 " " " "	53 0	9 4	10.5	5 4

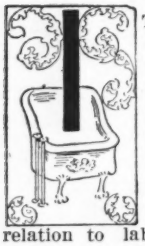
It will be seen that as the carbonic acid increases, the micro-organisms decrease in number. A similar result is obtained by classifying according to the strength of the draught.

	Carbonic acid	Organic matter	Micro-organisms
Strong draught	6 6	5.7	9 9
Moderate draught	7 5	8 8	8.9
Little or no draught	9.4	8 1	6.7
	In excess of outside air		
	Carbonic acid	Organic matter	Micro-organisms
Strong draught	2 6	3 5	— 2 3
Moderrte draught	3 9	6 6	— 9.2
Little or no draught	6 0	5 5	— 14 3

(To be continued.)

*In this case we have represented the relation of the number for sewer air to that for air in four-roomed houses by x, as the calculated number for sewer air is negative. The real value of x must be between 9-7=1.3, and infinity.

COMPULSORY VERSUS VOLUNTARY ARBITRATION.



IT was a motley gathering which met in Chicago December seventeenth and eighteenth at the invitation of the National Civic Federation to participate in the deliberations of that body on the theme of arbitration in relation to labor troubles. The labor leader, ardent and impatient of criticism, the large employer, diplomatic but firm, the statistician, bristling with information, the lawmaker, calm and judicial, and last but not least the comfortable middle-class citizen, usually too indifferent to take much interest one way or the other, but keenly alert and partisan when either of the parties to a labor war infringes upon his vested rights. Chairman MacVeagh likened this man to the grain between the upper and nether millstones, surely ground to pay the cost of conflict between the two great forces of labor and capital.

The great benefit to be gained from a meeting of this kind lies in the fact that it was a conference of thinking men, not a convention of delegates from bodies having an outlined policy to defend. True, the guests at the arbitration symposium sometimes forgot their table manners and criticized the opinions of others rather too freely, but on the whole the discussion was conducted in a spirit of the utmost courtesy and toleration. To quote the chairman's opening speech, "We have had plenty of discussion from the points of view of all sorts of dogmatic sets, classes, and organizations, but until now there has been no national forum where all leaders could meet and know each other, and where all opinions could be heard through their able and respected advocates, in the spirit and under the conditions of frank and tolerant discussion."

Perhaps the most remarkable characteristic of the discussions was the absence of a dogmatizing spirit. All of the speakers were men of ideas, men who had theories to support, but all were willing to admit that arbitration as a factor in the settlement of labor troubles was still in the experimental stage, and that therefore the most that could be done at such a conference was to study it in its every phase, seeking to discover its weak as well as its strong points and in the light of such discovery to take such steps as would make its adoption, in its best form, more general among those who are at variance.

There was a remarkable uniformity of opinion on one point under discussion upon which one might naturally expect the greatest divergence of opinion, that is, upon the expediency or inexpediency of so-called compulsory arbitration. Speaker after speaker dismissed it with a word and went on to discuss the subject of voluntary arbitration as a help of vast importance if, indeed, not an absolute solution of the great labor problem.

Arbitration versus conference came in for a large measure of discussion, some advancing the theory that master and man, as those most directly interested, could best settle their differences by conferences, while others held that an impartial arbitration committee could best decide the merits of the case because a stage removed from the heat of the conflict. Labor and capital were likened by one of the speakers to a quarrelsome married couple, who somehow cannot seem to get along with each other and yet could not possibly get along without each other. The general concensus of opinion on this subject seemed to be that so long as the couple are willing to settle their domestic troubles between themselves it is best for the outsider not to interfere, but that when the breach has widened so much that it cannot be spanned by mutual concessions it is time for the mutual friend to step in and after an impartial hearing of both sides of the dispute seek, by friendly conciliation, to bring about a settlement of differences. Conference so long as conferences are possible, but arbitration, not the strike and lockout, as a court of last appeal.

Another theory was indorsed with surprising unanimity, viz., the theory that combinations both of labor and capital make for industrial peace. It was agreed by nearly all the speakers that those trades are the least troubled with strikes and lockouts in which both the employing and the employed classes are thoroughly organized and so nearly balanced in respect of power that neither party might safely presume upon the weakness or unpreparedness of the other. Carrol D. Wright, United States Commissioner of Labor, gave this as the sum of his observations both here and in Europe.

Hugh H. Lusk, of New Zealand, for ten years a member of parliament there, favored the conference with a detailed description of the operation of the compulsory arbitration law there and spoke in terms of highest praise of the revolution it had wrought in industrial conditions in that far off land. Whether it would prove equally efficient here, if indeed it could ever be drafted in such a manner as to make it constitutional, he frankly admitted to be an open question. A lively brush followed his criticism of the dictum of Samuel Gompers, President of the American Federation of Labor, that labor had a perfect right to strike for any reason at all, or for no reason at all. This he characterized as not liberty but license.

The discussions on the whole embodied much that might be characterized as "common horse sense" and it is a matter of regret that lack of space forbids the printing here of even extracts from them. The proceedings will doubtless be published in full in due time and may be had of the Secretary of the Civic Federation, Mr. R. M. Easly, 215 First National Bank building, Chicago. Following is the major portion of the resolutions adopted by the conference and the names of those who were appointed as a standing committee to keep alive the good work so actively begun:

"To the end that tranquility in the industrial world may prevail, this conference on conciliation and arbitration would make the following recommendations to the American people:

"1. That employers and wage-earners should enter into annual or semi-annual agreements or contracts.

"2. That all industries in the United States should establish boards of conciliation within the several and varied interests to which boards of conciliation all differences and disputes arising between employer and employe, if not really adjusted between the immediate interests concerned, may be referred for settlement.

"3. Recognizing the fact that compulsory arbitration—aside from all other objections urged against it—is not at this time a question of practical industrial reform, and, whereas, such systems of arbitration as are now in vogue do not seem to fully meet the requirements of the different interests, and appreciating the importance of the subject,

"We therefore recommend that the presiding officer of this conference appoint a committee to serve for a period of one year, to be composed of six representatives of the employer class and six representatives of the employee class, these representatives to be selected as nearly as may be consistent from the different sections of the country, for the purpose of formulating some plan of action looking to the establishment of a general system of conciliation that will promote industrial peace.

"We believe that this conference will have in part, at least, failed of its mission unless it strenuously insists that the proper time to arbitrate is not after a strike or lockout has been inaugurated, but before it has begun. We fully realize that all plans of arbitration and conciliation will be unavailing unless we are all animated by a spirit of fairness and justice, and are willing to open our eyes to such rights as belong to every citizen."

The committee on resolutions and action is composed of the following:

A. C. Bartlett, vice-president Hibbard, Spencer, Bartlett & Co., wholesale hardware merchants.

Henry W. Hoyt, president National Founders' association.

Herman Justi, commissioner Illinois Coal Operators' Association.

G. Watson French, vice-president Republic Iron and Steel Company.

E. D. Kenna, vice-president Atchison, Topeka & Santa Fe railway system.

Chauncey H. Castle, president Stove Founders' National Defense Association.

Samuel Gompers, president American Federation of Labor.

John Mitchell, president United Mine Workers of America.

Martin Fox, president Iron Molders' Union of America.

Frank P. Sargent, grand master Brotherhood of Locomotive Firemen.

Henry White, general secretary United Garment-Workers of America.

James M. Lynch, president International Typographical Union.

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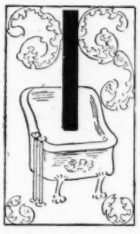


IT IS always refreshing to hear from a man who has the courage of his convictions and is not afraid to espouse the unpopular side of an argument. Such a man, apparently, is Ulysses D. Eddy, of the firm of Flint, Eddy & Co., of New York, who are perhaps the largest exporters of general merchandise in the United States. Speaking of the phenomenal growth of the export trade in the year just closed—a growth which puts this country in the lead of all other nations in commercial importance—Mr. Eddy, in a recent newspaper interview, advanced a theory to account for the phenomenon which is unique in its outspoken praise of an institution to which it is the fashion to attribute most of our commercial woes.

"What people call trusts," said Mr. Eddy, "are responsible for this phenomenal trade. Without such combinations of capital and interests as have taken place in this country within the last few years such growth in our foreign commerce would have been impossible. In the first place, it takes a great deal of money for a new dealer to build up a market in a foreign country, and few manufacturers in this country could afford to do so until they pooled their issues. Most of them were afraid to make the costly effort because they feared that as soon as they had cultivated a demand other manufacturers in the same line of goods would immediately take advantage of the results of their enterprise and expenditures. Few were willing to take the risk. Then, again, small quantities of merchandise cannot be handled with economy. It costs just as much to sell $10,000 worth of goods as $1,000,000 worth, on which the profits are, of course, so many times the larger. Therefore the trusts, or whatever you may call the amalgamated companies, are able to do a foreign business at a greatly reduced cost with much greater profits than private firms and corporations.

"It does not pay manufacturers to sell or ship small quantities. The difference in freight rates on a cargo and a single invoice is of itself a good profit. Formerly orders from foreign buyers were scattered among a dozen or a hundred different manufactories in small lots. Now they are concentrated in large lots, which can be handled at the same cost and the same trouble. This centralization not only enables us to produce but to sell and ship with greater economy.

"If you will notice the export statistics," continued Mr. Eddy, "you will see that the slowest growth in our foreign trade is in the dry-goods line. That is because the manufacturers are not organized. The most rapid growth is in the various forms of iron and steel, because the manufacturers in those lines are thoroughly organized and have made a united and intelligent attack upon the foreign market."

This sounds reasonable, and Mr. Eddy is deserving of credit for the frank declaration of the faith that is in him. Hitherto we have heard altogether too much from the prosecution and nothing at all from the defense, the inference naturally being that they came not to the light because their deeds were evil. Doubtless hostile public opinion has had much to do with sealing the lips of trust officials and when saner judgment shall have taken the place of popular fear of this bogy man, when politicians shall have ceased to convert that fear into political capital and the public press shall have learned that unreasoning abuse has palled on the public palate, it will be learned that this bogy man wasn't such a terrible fellow after all.

If a mere lay student in the field of economics might venture an analysis of the matter his analysis would be something like this: From time immemorial men have accepted without question the teaching of the sages that competition is the life of trade, with the result that business has been converted into a Juggernautal car for the crushing out of our manhood of every instinct except the commercial. Men have throttled every generous impulse and quieted their consciences with the assurance that they were but meeting the demands of business. Wages have been forced below the living point and mere babes put to work in order to reach a lower and still lower cost of production that competition might still be met. What has been the result when the law of competition has been allowed to work out its logical end? The sweatshop furnishes the answer. Unspeakable degradation of the laboring class, a revolting inhumanity on the part of the employing class.

In these latter days the germ of a new idea has been taking root. It might be formulated as follows: Co-operation is the life of trade. Competition has never been, can never be anything but the death of trade. To this new idea certain men, a generation ahead of their time, have become converted, and unlike most men who are ahead of their fellows they have reaped a golden harvest for their pains, not, however, escaping the abuse always meted out to innovators.

Like politics, this idea has made strange bed-fellows, and it is to be feared that they are not always frank with themselves and with each other. Take, for instance, the position of organized labor. No more vociferous opponent of trusts could be found than the typical labor leader, yet it would be hard to point out a more strongly intrenched trust than the federated labor unions of the country. But it is not expected that any union man will admit the soft impeachment. So, too, of the great aggregations of capital. In the doctrine of their promoters they are but "judicious combinations for the meeting of ruinous competition." Some day we shall hear from the consumers' trust. Then we may expect the price of our staples to be determined by the cost of raw material plus a living wage and a reasonable profit. Such a price the consumer could well afford to pay because of the fair price he received for his efforts in the commercial field.

What then of the future? The signs of the times seem to leave no doubt that the new idea has come to stay. And those who try to repel the invasion of an idea are like the silly king who thought to stop the incoming tide with his foolish little sceptre. It can't be done. But what can and will be done is this: Men with warm hearts and cool heads will take the idea, develop it along public-spirited instead of selfish lines, and make it the basic principle of business enterprises worthy to exist in a country whose governmental ideal is "of the people, for the people, and by the people."

That such an evolution of business methods and ideals will come about without periodical disturbances and without hardship to individuals is hardly to be expected. At the present stage of progress hundreds of thousands of men are suffering from the changed conditions of trade. But to admit that because this is so the future is dark and hopeless is to admit that we have lost in a generation the power in which our fathers grappled with grievous problems and brought them to a happy solution.

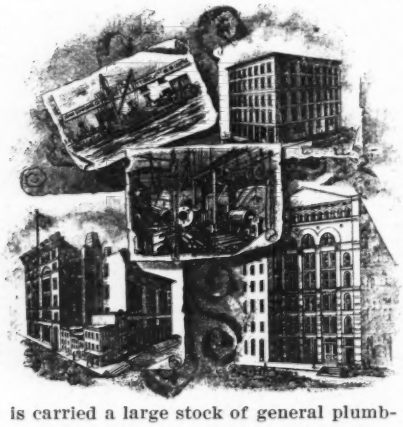
Apropos of the change that is coming over the spirit of our dreams, of the growing idea among employers that they owe their employes something more than wages, we cannot do better than to quote the sentiment of that great-souled man, Washington Gladden:

"I think of that morning on the shore of Galilee, where, after his resurrection, our Lord appeared in the early dawn to the disciples who had toiled all night and taken nothing. 'Children,' said the Master, 'have ye aught to eat?' They answered him, 'No.' And he said unto them, 'Cast the net on the right side of the boat and ye shall find.' They cast, therefore, and now they were not able to draw it for the multitude of fishes. If through the long night of the centuries the toilers on the sea of life have taken less than they hoped for, may it not be because they have sought their gains on the wrong side of human nature—on the side of selfishness and strife? And is it not His voice—the voice of the Son of man—that now, in the dawning of a better day, we hear bidding us cast the net on the other side; to believe that love is wiser than craft, and that the hand that is open to give will forever hold more of the good of life than the hand that is clenched to keep?"

A Solid Business House.

One of the largest establishments of its kind in the world is the John Simmons Company, of New York City. The main offices of the company are at 106-110 Centre street, at which place they have large and conveniently arranged counting rooms. The basement of the building is used for a warehouse for malleable fittings, the upper stories being devoted to brass goods and supplies, of which the company carries an immense line.

At Nos. 9 and 11 Franklin street connecting with the above stores, are the shipping and receiving departments. Here is carried in the first floor and basement a very large stock of cast iron fittings. On the second floor of the building are the offices of the export department and the general filing department, with the latest and most improved system for taking care of the company's correspondence. In the other parts of this building



is carried a large stock of general plumbing supplies, enameled iron and earthenware.

The company built and owns on Leonard street two large modern buildings, one of which (No. 155-157 Leonard street) runs through to Baxter street. On the first floor of this building are the pipe cutting machines. In the basement is carried a large stock of extra large fittings in cast iron, standard and extra heavy, screwed and flanged up to and including 16 inches. Here also is situated the power plant, dynamo, etc., as well as the department for coil building. On the upper floors they carry a large stock of recessed drainage fittings which are now generally used in all large buildings.

Until recently the company occupied a building, No. 85-91 Elm street, where they ran three or four of their pipe-cutting machines by electric dynamo, independent of their regular cutting shop. Here they cut and threaded pipe up to and including 18 inches, and carried a small stock of pipe for the local trade, a man being always on call, enabling them to give their customers prompt service in case of breakdown, at any time of night, as well as on Sundays and holidays. Owing to the opening of the street for the tunnel this place had to be given up and new quarters secured. They accordingly purchased and rebuilt another building in the same block as their stores and adjoining their shipping and receiving department, Nos. 5 and 7 Franklin street, to the ground floor of which they transferred the independent cutting shop or annex.

The second floor of the building, 9 and 11 Franklin street, has been fitted up as a model nipple shop, where many machines are kept constantly busy. On one of the floors a suite of apartments for the foreman of the nipple shop have been fitted up, so that he may be always on call for after hours as stated above.

The company has a bulkhead at Pier No. 51, with a warehouse opposite, No. 381 South street, running through to Front. Here are also the stables for the draft horses of the company. In this building they carry from 80 to 100 cars of pipe of all sizes from one-eighth inch to eighteen inches, standard, extra strong, and double extra strong.

The company has in use in the various establishments between thirty and forty pipe machines, but owing to the great demand have recently been obliged to add two new machines to the list. They have recently added a lathe thirty feet long with a forty-eight-inch swing, which has been placed on the floor of the main cutting department of the Leonard & Baxter street building. This will enable them to face and turn off the largest fittings and lengths of pipe likely to be called for.

All of the departments are connected by means of a private telephone switchboard, connecting their twenty-three instruments, which greatly facilitates the management of so many and widely separated departments of the work.

Taken all in all the Simmons Company have an equipment for their work which could hardly be surpassed for completeness and convenience.

The very large and complete assortment of the stock they have carried for many years has established a proverb in the trade, which is—"If you don't find it at John Simmons Company, it is not to be found."

A New Method of Sewage Disposal.

The growth of population in this country, and particularly the growth of cities, has turned the attention of many to the subject of sewage purification. A method that receives widespread approval is that of the septic tank. In a letter to Dr. Baker, of the Michigan State Board of Health, John W. Alvord, C. E., of Chicago, gives the following brief history of the septic tank: "The septic tank was first installed at Exeter, England, in 1864, on a large scale by Mr. Donald Cameron, the Borough Surveyor, and has been in use ever since with marked success. It has, however, been subject to much controversy, and it is evident that for all kinds of sewage, some care must be used and great experience must be had with it before it can be certainly successful in every case. It is quite evident that in all filter beds, whether covered or uncovered, all anaerobic and aerobic organisms have their place. In the ordinary sand filter the aerobic organisms operate freely in the upper layer of the bed while the anaerobic organisms are found in the lower portions of the bed where they are not exposed so freely to oxygen and light. Aerobic organisms have been found in the septic tanks as well as the anaerobic variety. In this connection, see the very interesting report made by Dr. Sime Woodhead to the Baltimore sewage commissioners last year."

Septic tanks have been installed in a number of places during this last year, and a large one has been in operation for over six years at Champaign, Ill., and Kewanee, Ill. The Champaign tank was designed by Prof. A. N. Talbot of the University of Illinois, and was installed about the same time as the Exeter tank. This is a very successful tank and gives high rates of purification.

Another tank has been installed and is in operation at Kewanee, Ill., also designed by Prof. Talbot; and a very large tank is now being built at Marion, Ia., designed by Mr. F. Herbert Snow, of Boston, consulting engineer. Michigan has not been behind hand in experimental work along this line. Last March there was installed at Holland, Mich., a small experimental septic tank which took the sewage from the City Hotel, a bank and several stores, and has worked very successfully during the entire season. Dr. Baker visited the tank with Mr. De Young, the superintendent of public works of the city of Holland, and was much pleased with the work it had been doing during the summer. It has received about ten to twelve thousand gallons of sewage per day, and it is computed from the grains of suspended matter per gallon, that it has satisfactorily oxidized about one hundred cart loads of sewage sludge, causing so much to totally disappear. This without any offense of any kind, either about it or in standing right upon it. The effluent from the tank is emptied into a marsh, and is subject to some slight further decomposition, showing that a perfect plant would need after treatment. It is proposed that Holland, after further experience of the winter, will install several of these tanks for the disposal of the city's sewage, and will modify somewhat the system designed for this purpose.

BURGLARS MAKE A HAUL.

Albany, N. Y., Dec. 22.—(From a Staff Correspondent.)—During Tuesday night, thieves forced an entrance to Thomas W. Prior's plumbing store at 201 Central avenue. About 300 pounds of solder were taken.

WISCONSIN STATE CONVENTION.

THE annual convention of the Wisconsin State Association of Master Plumbers came to order at the fall of President Dengel's gavel in the St. Charles Hotel in Milwaukee at 10 a. m., Thursday, January 9th. The roll call showed that a very small proportion of the delegates expected from out of town had yet arrived, the greater number of them coming in on morning trains and reporting in time for the executive session, which was called for two o'clock.

There was very little preliminary sparring, the meeting being apparently strictly for business. President Hanley of the Milwaukee local welcomed the convention on behalf of his colleagues in a very few words, promising the delegates that the entertainment committee had a program for their leisure hours which he trusted would make their stay in Milwaukee thoroughly enjoyable.

President Dengel accepted the proffered hospitality of Milwaukee local on behalf of the state association, and assured its president that the delegates would be very glad to play out of school hours.

The roll was then called by cities, the following delegates responding to their names:

APPLETON, W. S. Patterson & Co., Ryan & Long.

BARABOO, John Arnott.

BELOIT, Franz & Newton, C. S. Gregory.

COLUMBUS, E. L. Pine.

FOND DU LAC, Friedel & Seresse.

GREEN BAY, Sanitary Construction Co.

KENOSHA, Chas. H. Goodman.

LA CROSSE, Fetter, Baker, Nieber Co.; Jas. A. Trane.

MADISON, Geo. Kraft, Melzer & Hyland, Wm. Owens, Jos. Sutter.

MENOMINEE, A. F. Schoenhoff.

MILWAUKEE, J. Belz, Bringlinger & Stuckert, B. Dale, F. Dengel & Co., Dearsley Bros., E. H. Disch, Ed. Dillman, Dorrier & Cook, Edgar Downer, E. T. Doyn, W. H. Egan, Wm. Ehrbach, P. A. Fuchs, Wm. E. Goodman, Grassler & Gezelschap, Frank Griebel, Wm. H. Halsey, G. V. Hanley, Chas. Harper, P. Jensch, Fred Julien, J. B. Julien & Co., Chas. Kinzer, Chas. Kunkel, Hugo Lippert, A. J. Maag & Co., A. Meloy, L. F. Meyer, Murphy Bros., Chas. Polacheck & Bros., H. Roth, Chas. Schumann, A. R. Schwind, H. Siebert, F. J. Smith, L. R. Stollberg & Co., Stemper Bros., Ben Tank, Chas. Voelz & Bros., Wenzel & Hensch, W. T. Werner, J. Williams, W. Winneman, Wittig Plumbing Co., Jos. Wittig, Martin Van Roo.

NEENAH, C. W. Nelson.

OSHKOSH, J. Geo. Mueller, O. A. Toner.

RACINE, O. C. Davis, J. Voelkers.

SHEBOYGAN, Louis Sonntag.

SUPERIOR, Neil & Co., Stack Bros., J. P. Wray & Co.

WATERTOWN, D. F. Kusel.

Routine business was taken up in its regular order, the president's annual report, the reading of the minutes of the last meeting and the reports of the state vice-presidents being, on motion, carried over until the executive session.

The following committees were recommended by the convention and appointed by the chair:

COMMITTEE ON RESOLUTIONS—A. R. Schwind, L. F. Meyer, A. J. Maag, all of Milwaukee.

AUDITING COMMITTEE—Geo. Kraft, of Madison; G. B. Gregory, of Beloit, and J. B. Julien, of Milwaukee.

THE EXECUTIVE COMMITTEE was composed of the following gentlemen:

F. R. Dengel, of Milwaukee, president of the State Association.

W. F. Stack, of Superior, vice-president.

Chas. Polacheck, of Milwaukee, past president.

Geo. Reeke, of Green Bay, treasurer.

Hugo Lippert, of Milwaukee, secretary.

L. R. Stollberg invited the convention to attend in a body a theater party which was to be given in the evening by Milwaukee local for their delectation. Only eight men out of the hundred and odd present begged to be excused. A recess was taken until two o'clock, the interim being given over to the cementing of old friendships among the members and the making of new ones. Little groups of delegates gathered in the various rooms grouping around the hotel lobby and discussed the subjects that were uppermost in their minds. It was obvious to any one that the utmost harmony and good feeling prevailed in the ranks of the members, whatever might be their difference of opinion on the subjects under discussion. Cigar smoke was thicker than Chicago air, and occasionally little bunches of individuals who found the smoke irritating to their throats would pass through the little doors that lead to the dispensary of liquid refreshments.

Promptly at two o'clock the convention was called to order in executive session, and all who knew not the password were excluded from the charmed portals of the convention hall. All that transpired there may never be known to the vulgar uninitiated, but whatever the nature of the business transacted it was not at all displeasing to the majority of the delegates, and resulted in no disturbance of the feeling of good fellowship which was still very much in evidence after the adjournment of the meeting.

In the evening the local plumbers called at the hotel and escorted the delegates in a body to one of Milwaukee's popular theatres, where vaudeville reigns, and the whole crowd pitched in to enjoy an evening of frivolity after a day of serious deliberations. Certain ones of the audience were picked out—presumably because of their well-known good nature—as targets for the wit of the performers, who had, of course, been coached up so that they were able to make some very telling hits. The usual string of jokes about the length of the plumber's bill was also sprung, and each one evoked a hearty laugh from the audience in spite of its extreme age. The fact was the plumbers were out for a good time and were bound to enjoy themselves. However, the show was a very good one of its class, and Milwaukee local had no reason to feel that its hospitality was not appreciated by its guests.

At Thursday's sessions executive business was again taken up and the reports of officers received. The district vice-presidents reported business in their respective sections very good, and the working of the association as thoroughly harmonius.

The following officers were elected for the ensuing year:

President, F. R. Dengel, Milwaukee.

Vice President, J. P. Wray, Superior.

Treasurer, Geo. F. Reeke, Green Bay.

Secretary, Hugo Lippert, Milwaukee.

District Vice Presidents: F. E. Green, Janesville; Louis Sontag, of Sheboygan; J. A. Trane, of La Crosse; Jos. Niel, of Superior.

Delegates to the National Convention: Chas. Polacheck, of Milwaukee; Jos. Niel, of Superior.

Delegate to I. S. League: S. V. Hanley, Milwaukee.

Resolutions of condolence to the family of Herman A. Wittig were adopted and spread on the record.

Beloit was chosen as the next convention city.

In the evening a banquet was served to the delegates in the dining room of the St. Charles, which we may be sure few failed to attend. Your representative was unfortunately compelled to be absent from this function in order that the readers of "Domestic Engineering" might have this report in this week's edition. From the handsome manner in which the delegates were entertained up to the time of his departure, however, it is safe to conjecture that the affair was an elaborate one to which full justice was done by all who were lucky enough to attend.

RESOLUTIONS ON THE DEATH OF HERMAN A. WITTIG.

At a meeting of the Milwaukee Master Plumbers' Association held November 19, 1900, the following resolution was unanimously adopted:

Death, sudden and unexpected, has invaded our ranks. The Grim Reaper has cut off one of our best members, Herman A. Wittig. His sudden taking off was, as it were, a thunderbolt from a cloudless sky; the lightning flash that rent our hearts. It was a shock so sudden, so terrible, that we could hardly realize it was true. It was a reality, painful and sorrowful to contemplate, but the contemplation brought vividly to our minds his many good attributes as a member of our association and the community in which he lived. Loving and loyal in his friendships, diligent in his work, practical in his methods, enthusiastic in his undertakings, faithful to his trusts, conscientious in his obligations, impartial and fearless in the performance of his duties, earnest in expression, sincere in his convictions, he was to our association an honest and true member. We mourn his loss and

Whereas, The Milwaukee Master Plumbers' Association, realizing that their loss, though great, is as nothing compared to the affliction imposed on his family by his death, and trusting that the Divine Ruler will give them the necessary strength and fortitude to bear up under their great and sorrowful burden the members of the Milwaukee association hereby resolve:

That the president of this association, in behalf of the members thereof, tender to the family and relatives of our deceased brother their most heartfelt sympathies, and that a copy of this resolution be spread upon the minutes of this meeting as a mark of respect to the memory of Herman A. Wittig.

Convention Notes.

H. A. Luedke, of 313 Grove street, Milwaukee, was not inclined to take a very cheerful view of the present situation or of future prospects. Cheer up, Luedke; there's a good time coming.

Stemper Brothers, of 314 National avenue, Milwaukee, report that they never had a better year since they began business than the season just closing. This in spite of a rather late start.

Messrs. J. Geo. Miller and O. A. Toner were delegates from the much maligned city of Oshkosh. Plumbers there have had a very good season, but the heating trade has not kept pace. Even in that branch, however, there has been small cause for complaint.

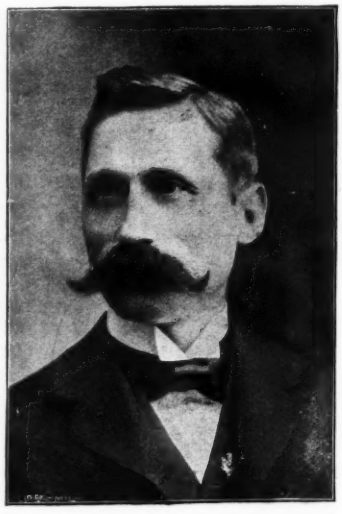
D. & F. Kilsel, of Watertown, are hardware merchants as well as plumbing and heating contractors. They have found business rather dull in all branches this season, but look for a brightening up of trade with the spring building.

Wm. Pine, of Columbus, has a town of 3,000 inhabitants to himself, with only occasional competition from outside sources. He is kept just about comfortably busy on water works jobs and installing the dry well system of sewerage, the town having as yet no public sewer system. Plumbing under these conditions differs much from city work, and as Mr. Pine is an enthusiast on plumbing problems, a chat with him proved instructive as well as interesting.

E. Rickersberg, of the United Brass Manufacturing Company, of Cleveland, was the guest of the Polacheck brothers, and apparently enjoyed the hospitality of the city as much as though he were himself a knight of the deadly torch. He says he expects to be up in that corner of the country a good deal now, having quit the profession of globe trotting and settled down to cover a certain territory thoroughly and often. Good luck to him.

FRANK R. DENGEL, OF MILWAUKEE.

Frank R. Dengel, whose portrait appears herewith, is the genial plumber who has, as president, guided the destinies of the Wisconsin Association



through the past year. In business meetings he is a strict disciplinarian but never loses that affability which is the secret of his popularity among all with whom he comes in contact.

LATER—Since the above account was sent in Mr. Dingel has again been elected to the presidential chair. We congratulate the Wisconsion association on their good judgment in returning to office a gentleman who has proved himself so eminently fitted for the place.

O. C. Davis, of heater fame, was in Milwaukee during the convention and gave your representative a good account of plumbing and heating conditions in Racine, his home city. He has again entered the plumbing field after having temporarily given it up to push the sale of his hot water heater. From all accounts, Mr. Davis has a very good thing in his heater patents, and a company to manufacture them on a large scale is one of the possibilities of the near future.

The irresistable Currier, of R. Estabrook's Sons, Boston, was present in all his glory, and regaled the delegates with song and story, the burden of both being, of course, the merits of his pet hobby, the Sisson Insertable Joint. Currier calls himself a missionary, his mission being evidently to convert men into smokestacks. He is a good fellow, is Currier, and plumbers who have looked upon his genial smile will not soon forget him or his specialty.

An impromptu bowling party was organized before supper Wednesday evening, and some rattling good scores were made. The northern delegates seemed to have the best of it, Reeke, of Green Bay, Sontag, of Sheboygan, and Nell, of West Superior, rolling up big scores. Stollberg and Polacheck, of Milwaukee, showed that they understood the science of the game. Your representative, however, brought down disgrace upon his head by allowing most of the balls to roll into the sewer.

Among the recent changes in the Milwaukee trade is the retirement of Mr. Barney Pripps, who was associated until recently with the firm of F.W. Pripps & Bro. Mr. B. Pripps retires in order to give more of his attention to his large number interests in Iron county, Wisconsin. F. W. Pripps commenced business in 1880 and in 1894 took in his brother Barney as partner. F. W. Pripps, whose business integrity and uniform courtesy have won him a host of friends, will continue the business alone. His many years of untiring effort have secured for him a very fair proportion of Milwaukee's plumbing business.

M. F. Jones, of Philadelphia, recently set Cooper's fixtures in the bath room of Mr. John C. Hahn, of that city.—Adv.

CITY FATHERS MAKE A STAND.

The following ordinance, recently passed by the city fathers of Anniston, Ala., is certainly an unusual bit of paternal legislation, but who shall say that it is not a step in the right direction:

"AN ORDINANCE

"To Require the Use of Toilet Paper in the Water Closets in the City of Anniston, Ala.

"Be it ordained, by the City Council of Anniston, That, on and after the passage of this ordinance it shall be unlawful for any person to use any paper in the water closets in the city of Anniston, except toilet paper.

"Be it further ordained, That any person violating the provisions of this ordinance shall, on conviction, be fined not less than five nor over twenty dollars.

"A copy of this ordinance to be furnished each householder.

Approved: O. Z. Henderson, Mayor.

"Adopted Sept. 13, 1900."

Items of Very General Interest.

BATH TUBS FOR TENEMENTS.

Cincinnati, O., Dec. 19.—(From a Staff Correspondent.)—There was a feeble gasp of opposition to the tenement house bath tub ordinance, last night, in the Board of Legislation, which was ruthlessly put out of the way by the efforts of its friends. The ordinance passed, and hereafter new tenement houses will have to be equipped with bathing facilities for all the tenants, unless the courts shall determine that such an act cannot be legal.

Mr. Mullen, the author of the measure, however, says he thinks the ordinance can be enforced just as any other regulation which the building inspector must enforce, and he thinks besides that it is an ordinance that will do a great deal of good for poor people in crowded tenements, while not being a hardship on landlords.

BY WAY OF SHOWING APPRECIATION.

Columbus, O., Dec. 24.—(From a Staff Correspondent.)—D. H. Sowers entertained Thursday night with a banquet at his new home, 1134 East Broad street, for the men who built the house. There were about 100 present, composed of the architects, contractors and workingmen—stonemasons, bricklayers, carpenters, plumbers, slaters, etc.

The banquet was in charge of James Goodale and the tables were spread in the ballroom, which was tastefully decorated. An elegant menu was served. Mr. Sowers acted as toastmaster and short speeches were made by a number of those present. Music was furnished by the New York Trio.

ASK FOR HEATING FRANCHISE.

Lincoln, Ill., Dec. 24.—(From a Staff Correspondent.)—The street railway company has applied for a franchise for a heating plant in the city. It asks for privilege of excavating to lay pipes, etc. The central plant will be at the power house, on Kickapoo street. The pipes are to extend through the entire business portion of the city, west to Broadway and to Elm street, and east and north into the Fifth ward. The council listened to the reading of the franchise with favor and are disposed to grant the franchise, provided they have assurance that the work will be done and the plant equipped properly. A heating plant is something desired and much needed, especially in the business section of the city.

QUEENS BOROUGH PLUMBERS.

Jamaica, L. I., Jan. 4.—The Master Plumbers' Association of Queens Borough met in the store of George Jerry in Jamaica yesterday, the meeting place having been changed from Long Island City. A contribution of $25 was forwarded by the association to the Galveston sufferers.

MANHATTAN'S NEW OFFICERS.

Manhattan branch of the New York Association of Master Plumbers has elected the following officers:

President, Andrew H. Brown; vice-president, Bartholomew F. Donohoe; treasurer, Philip Brady; recording secretary, Thomas A. Hill; financial secretary, Joseph F. Sweeney; sergeant-at-arms, Terence J. McCormack; marshal, Wm. Kirchof; trustees, Thomas J. Tuomey, chairman, Isaac O. Shumway, John Renehan, Charles Tucker, Isaac J. Brown. Members executive committee, "Greater New York Association," Andrew H. Brown, Thomas A. Hill, ex-officio; Isaac J. Brown, Samuel L. Malcolm, John Renehan, Thomas F. McCaul, Philip Brady, Terence J. McCormack, Wm. J. McDermott, Milton Schnaier, James F. Kelly, Frank Reynolds, Edward J. Brady, Geo. F. McQuillen, Bart. F. Donohoe, Isaac O. Shumway, Jonas A. Rossman, Thomas F. Gaynor.

NO RIGHTS IN MINT.

Denver, Colo., Dec. 20.—(From a Staff Correspondent.)—City Plumbing Inspector McBryde was informed this morning by Police Magistrate Thomas that the city had no rights whatever inside the grounds devoted to the new mint building. The court held also that the plumbing in that building need not be subject to inspection under city ordinances, as are buildings erected by private individuals within city limits.

SCHEME FOR REMOVING PAVEMENTS.

Omaha. Neb., Jan. 9.—Plumbing Inspector Cook says that when cold weather comes on there will doubtless be more or less trouble about the freezing of water pipes. Where it is necessary to get down to the pipes through stone pavement he suggests that a quantity of gasoline be poured in the interstices and set on fire. The heat, he says, will allow the paving blocks to be removed almost as easily as in the summer time. This plan will be followed here when it becomes necessary to tear up any stone paving this winter.

OVER AN EMBANKMENT.

Pittsburg, Pa., Dec. 26.—(From a Staff Correspondent.)—A horse and wagon belonging to Frank Carothers, a plumber, of Center avenue, and driven by William Jones, rolled over an embankment along East Herron street yesterday. Jones escaped by jumping. At the foot of the hill the horse became wedged in between a house and a wall. All efforts to lift the animal by rope and tackle failed. Finally Inspector J. N. Kidney, of the Humane society, who had been called, asked for volunteers to take down the wall. After five hours of work the wall was torn out sufficiently to remove the horse, which was found to have suffered but little injury.

PLANNING MANY IMPROVEMENTS.

Yankton, S. D., Dec. 16.—(From a Staff Correspondent.)—It has been practically decided that active work will begin at once in the spring upon a new water system for the city of Yankton. The plans provide for the exchange of the present undesirable artesian water for Missouri river water and will include, with the laying of new mains in the principal streets, the adoption of a heating system to be supplied for the whole city from the waste steam of the pumping station. The system is entirely practical and will be expected to supply steady heat for a business or residence building without any of the troubles of keeping up fires and at less expense than is now incurred for the purchase of coal alone. The city, in the spring, will probably also add its own electric light system to its numerous contemplated improvements.

ADOPTS NEW PLUMBING CODE.

Oakland, Cal., Dec. 16.—(From a Staff Correspondent.)—At the regular meeting of the board of health last night a plumbing ordinance formulated by the members of the plumbing committee, aided by Sanitary Inspector Smith and a representative of the Plumbers' Association, was adopted. It was then referred to the council with a recommendation that it be adopted as a substitute for the ordinance prepared by the council.

Dr. Maher, of the committee on plumbing, stated that the new ordinance embodied the best features which could be suggested by Sanitary Inspector Smith and Mr. Sturm, of the Plumbers' Association; that it was copied largely from ordinances now in force in other cities, and that he hoped it would prove satisfactory.

The new ordinance contains the following additions and changes:

In addition to filing notice and plans at the health office of work done, all plumbers must also give the name of the owner of the premises, the architect and the exact location of the building.

All cast iron pipes and fittings under ground and under buildings must be of heavy material.

When buildings are moved or erected upon lots on which sewers are already laid, the old sewers must be replaced by cast iron sewer pipe.

Vent pipes must extend at least six inches above the center ridge pole of all buildings. The pipe must be filled with water and tested before the work be accepted by the inspector.

The new ordinance also contained a number of other changes which it is thought will tend to protect the people from diseases resulting from defective plumbing as well as a number of minor changes for the benefit of the plumbers.

To Start Crusade.

Portland, Ore., Dec. 20.—(From a Staff Correspondent.) — Plumbing Inspector Hulm has found a district in the vicinity of Fifth and Sixth and Sherman streets where all the houses have old and defective plumbing. He says that there has been a number of cases of sickness in this district and this led to an investigation which resulted in the discovery of a lot of defective plumbing. There is a sewer convenient and he will serve notice on the residents of this district, which covers about a block, to place their houses in sanitary condition at once.

Plumbers' Advice.

Chester, Pa., Dec. 26.—(From a Staff Correspondent.)—Plumbers caution the people about the care of the water backs in the kitchen stoves, especially in view of the accidents that have occurred in this city during the past few years.

"Before putting the draft on the kitchen stove in the morning try the warm water spigot in the sink and if it is not running, do not let the fire come up. If the ordinary means for thawing out the pipe are unsuccessful, send for a plumber as the best way to save money. Never attempt to thaw out a frozen pipe by building a fire in the kitchen stove. It is dangerous to use the kitchen stove if the water cannot circulate in the boiler and an explosion is likely to result."

Cities May Furnish Heat.

Omaha, Neb., Dec. 20.—(From a Staff Correspondent.)—Events may prove that the decision of the Nebraska supreme court, handed down last spring, declaring unconstitutional the act under which cities of the first-class, with populations not less than 5,000 or greater than 25,000, are incorporated, will ultimately result in the inauguration of a vast system of municipal heating.

The decision of the court necessitates the drafting of a bill repealing the old law and providing a new. The mayors of a number of the cities coming under this provision, Fremont, Nebraska City, York, Grand Island, Hastings and Beatrice, have conferred for the purpose of drawing up a new bill which shall be complete and desirable in its every detail, giving the cities under its jurisdiction all of the privileges and liberties possible. One of these new and hitherto unknown features in this state will be set forth in a clause giving to municipalities of this class the right to establish and operate public heating plants.

"We furnish the people light and water as it is, so why not give them warmth and comfort in winter as well?" said Mayor Fred W. Vaughan of Fremont, who was in Omaha yesterday looking up data for the new act from various sources.

"Municipal heating is surely one of the next things in the way of municipal progress. We are approaching the time when it will be demanded. When the people begin to appreciate how much pleasanter, cheaper, more comfortable and thoroughly satisfactory it is to have a constant, equitable heat in their houses in winter, without the dust, dirt and annoyance of coal and stoves, it will not be long before the idea grows into an established fact."

Robbers Make Big Haul.

Kansas City, Dec. 14.—(From a Staff Correspondent.)—The burglars, who invaded the plumbing shop of Lohoefner & Kiernan at 2300 Washington avenue twice during Tuesday night were very bold, evidently knowing there was little danger of police molestation. They made two trips, carrying off everything of value in the shop, including two bath tubs, two tons of lead pipe, several hundred pounds of brass fittings and a lot of tools. Not satisfied with this plunder they went even further, forced open a stable in the rear and stole a wagon and a lot of harness. The wagon was used to haul away the plunder, making two trips. In all the property stolen is valued at $1,000. Both burglaries were reported to the Four Courts.

The burglars were kind-hearted to a certain extent. They brought along their own horse to use in hauling the plunder. Not having any use for the horse of the plumber it was not stolen.

Two Big Contracts.

Blue Island, Ill., Dec. 27.—(From a Staff Correspondent.)—Vaudenberg & Pronger have recently closed two large contracts that will keep them hustling for some time. One is with the Midlothian Club for a large amount of piping and heating apparatus, and the other is with the Montgomery Ward Co. for their large warehouse and factory which they will erect at Chicago Heights. The right kind of work, the right kind of prices and the "get there" feature always wins.

Building an Elegant Bath.

Indianapolis, Ind., Dec. 22.—(From a Staff Correspondent.)—The Jungclaus company is building a costly bathhouse for the Indiana Mineral Springs Company, near Attica. It will cover an irregular space about 120 by 175 feet. It will be one of the finest establishments of its kind in the country, with its tile floors and marble wainscoting; its dressing rooms, rest rooms and rooms devoted to social purposes. The building will be steam heated; its cost, $45,000.

Officially Decapitated.

Columbus, O., Dec. 22.—(From a Staff Correspondent.)—Joseph Beatty, city inspector of gas taps, has had his official head removed, and he will no longer be in a position to gather in stray $10 from plumbers who want inside information for private gain.

Beatty was suspended yesterday morning pending an investigation of the charges made against him. City Engineer Griggs was designated by Director Kauffman to conduct the investigation. Mr. Griggs had a conference with Beatty yesterday and as the latter pleaded guilty to the charges against him his official decapitation followed as soon as Mr. Griggs had made his report to Director Kauffman.

A Plumber Officer in Trouble.

St. Louis, Mo., Dec. 12.—(From a Staff Correspondent.)—A representative of the Supervisor of Plumbing secured a police court summons yesterday against Police Officer George Geekie for violating the city ordinance regarding plumbing. The complaint is that Geekie, who was a plumber previous to joining the force, has been doing plumbing work in the police station in course of erection at Magnolia and Grand avenues without having first given bond and being registered. He is also accused of having failed to send a duplicate of the plans and specifications to the Building Commissioner's office. Geekie says he did nothing wrong, as he is under the orders of the police department.

Careful Work Brings Good Results.

Morrison, Ill.—(From a Staff Correspondent.)—Mr. Henry Sauer has been in the hardware and plumbing business in Morrison for the past twenty years. His start was made in a small way, but by industry and good management he has gradually enlarged it until at the present time he occupies one of the largest establishments and has one of the largest business houses in the city.

Aim to Give Satisfaction.

Saginaw, Mich.—(From a Staff Correspondent.)—The firm of Brown Bros., plumbers, is synonymous in Saginaw, with the highest class of work done in the city, in plumbing, steam and gas fitting, etc. Years of faithful, exacting work has built for them this reputation and each year adds to it. Their work is done with an aim of giving complete satisfaction, and what is of greater importance, they do it. The firm is composed of William A. and Malcolm E. Brown, both plumbers of years of experience.

A Dainty Calendar.

Wm. Bishop's Sons, of 205 South street, New York City, and 724 Third avenue, Brooklyn, send us a dainty calendar for the new year—a picture of a roguish little girl who smiles bewitchingly from a tangle of curly locks. The calendar is certainly charming in every respect.

A Vision of Loveliness.

Charles Perkes, of 627-629 Arch street, Philadelphia, sends us a calendar for 1901 which ought to please the most fastidious beauty lover, if bright eyes, a laughing face and a wealth of gold-brown hair have the power to charm. Mr. Perkes has been in the manufacturing business nearly a half century and ought in that time to have gained some experience as to the needs of plumbers and the way to meet them. Doubtless he will send you a calendar if you mention "Domestic Engineering."

WHAT ONE MAN THINKS OF "DOMESTIC ENGINEERING."

Letters like the following are always most welcome to the staff of "Domestic Engineering." Our aim is to publish a thoroughly useful journal. If you think we are succeeding, we are always glad to hear you say so; but if you have anything in the way of candid criticism to offer, it is equally acceptable.

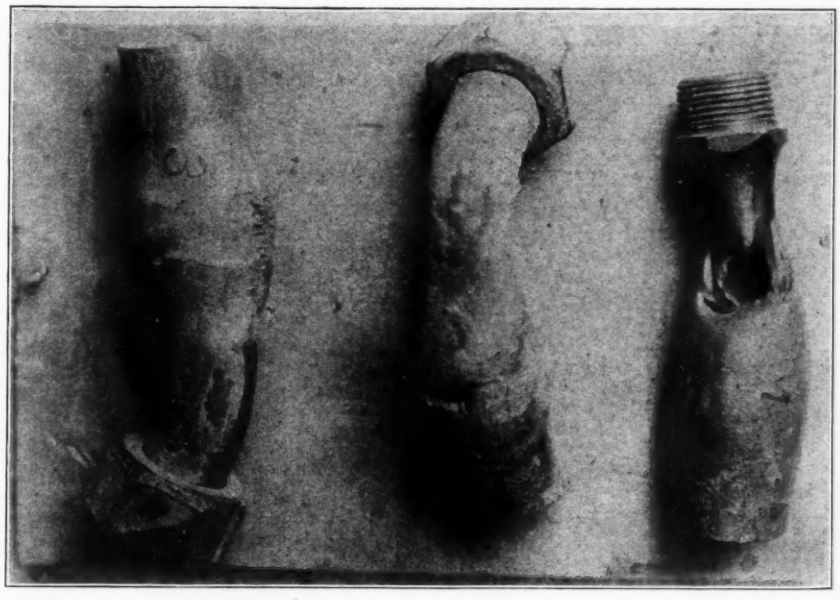
"The 'Domestic Engineering,' Chicago, Ill.:

"Gentlemen:—I have received two copies of your monthly paper on a year's subscription, and consider that I never made a better investment. I hope to see some more letters like those which appeared under the head of 'For the Individual' and 'Practical Plumbing,' in the December issue. I am yours very respectfully. Wm. H. Conklin."

A PECULIAR WORKING HOT WATER JOB.

Norwich, N. Y.—To the Editor of "Domestic Engineering."—Sir: I send here enclosed a rough sketch of a hot water heating job that works in a peculiar manner. The main (shown in the upper portion of the sketch and marked heater) is two inches. It turns at right angles at point marked "A". At "B" it is reduced from 2 in. to 1½ in. and a 1¼ in. branch is taken off the top with a 45 degree ell and to riser for radiator on second floor. A 1½-in. main continues to a point marked "C", at a distance of about 5 feet, where it is reduced to 1¼ in., and a 1¼-in. branch is taken off the top to supply a radiator on the first floor, about 2 feet away. The end of the main turns up with a nipple and elbow and runs about 2 feet to a riser where it is reduced to 1 in. and supplies a radiator on the second floor. The radiator "D" on the second floor works all right. After we leave the "T" (2-in.x1½-in.x1¼-in.) at "B" is where the trouble begins. The water will circulate through pipe "E" and radiator "F" all right for a short time, and then it will stop and begin circulating back through the 1½-in. return from the tee "H" and up the riser to radiator "K" on the second floor. It will continue this backward circulation a short time, perhaps one half hour or thereabouts, and then it takes another start and circulates as it should through the floor pipe "F" and radiator "F." Radiator "F" will heat very well, but radiator "K" does not get hot, only warm. It keeps changing from the right circulation to the reverse and vice versa.

This reversal of circulation is what I would like to have explained. What causes it to change backward and then forward? I have seen circulations reverse before, but I never saw it change backward and forward before. If you can give me a remedy, and will attend to this at your early convenience, it will greatly oblige an old subscriber.



REPLY.

We would suggest the use of eccentric fittings where our correspondent reduces the size of the main, as friction caused by the use of ordinary fittings could easily cause the trouble you complain of. A full-size, two-inch main would be better if it was extended to where the pipe was reduced to one inch. To answer your inquiry more fully the size and make of the boiler should be given, as there are boilers which, when the fire becomes intense from pushing too hard, will throw the water up the return. It should be understood by all fitters that if eccentric fittings are used where pipes are to be reduced in size, the reduction should be made by running full size to an elbow, and in case of hot water the elbow should look up, while in steam pipe, as a rule, it should look down.

PLANT ALMOST COMPLETED.

Big Rapids, Mich.—At the new plant of the Michigan Heater Company the finishing touches are being put on. The large foundry room is now being clayed, the material being brought by the train load. It is expected that by the 10th of January active work will begin in the foundry proper.

DAMAGE TO LEAD CONNECTIONS.

Omaha, Neb., Jan. 3, 1901.

Domestic Engineering, Chicago, Ill.

Dear Sir: Herewith note photo showing damaged lead connections; and upon careful examination showing the importance of air cushions on supplies. No. 1 cut out as shown was at curb stop. It is a well formed, fine metal joint and was in the ground about a year. The feature I could not account for is that there are fins turned in all around the hole as if the wearing flow had been from exterior instead of interior. The pressure was 60 to 70 pounds. Nos. 2 and 3 are tail pieces from corporation cocks at main. Upon examination these

were found to be on services upon which were used lever-handled bibs without air cushions under 80 pounds pressure. Upon examination I found the strain and concussion at the corporation cock to be the most severe of any point on the whole service, it apparently having gradually pounded the solder joints out until a hole was torn. Nos. 2 and 3 were in service about ten years, but the lever-handled bibs were on but about one year, thus plainly showing the effect.

Very respectfully,
W. S. Cook.

SIZE OF HOT WATER MAIN.

Clearfield, Pa.—To the Editor of "Domestic Engineering"—Sir: I purchased from you some time ago a book entitled "Modern Plumbing, Steam & Hot Water Heating." On pages 338 and 339 of which, under the heading of "A Good Method of Hot Water Pipe, etc.," I find no rule or method of determining the size of main. Enclosed find rough sketch of a small job I have to do on the one pipe system. Will you kindly advise me at your earliest convenience the size of main required on the job?

REPLY.

Our correspondent seems to have a very good idea of the method of doing a single pipe job so that by simply answering his inquiry as to the size of the main required, we give all the information necessary. He should use a two inch main full size to the boiler which will be ample for this job, and which we may say, is as simple as should ever be used in connection with a hot water plant.

PROPOSE AMENDMENTS TO PLUMBING CODE.

Erie, Pa., Dec. 30.—Messrs. Campbell and McIntire, representing the Master Plumbers' Association, presented a series of amendments to Erie's plumbing code at last night's health board meeting. The list of amendments included: Permit the use of both tile and iron pipe for house drainage; permit the use of "Standard" instead of "extra heavy" cast iron pipe in other plumbing; permit the use of "plunger" closets in basements; abolish plumbing inspector's fees for examining and certifying to plans; reduce fee for inspecting and testing finished work to one-half the present rate.

Mr. Campbell spoke at some length from the plumbers' point of view. He said that the stringent plumbing rules had hurt their business; that their store rooms were stocked with plumbing apparatus that the poorer class of people could not afford to use under present conditions. He found that dozens of outdoor closets were being built, where, with reasonable regulations, the plumbing would be put in the house. Taking this fact into consideration he questioned whether the stringent rules were a success from a sanitary point of view. He declared that 99 people out of every 100 wanted the privilege of using tile pipe instead of extra heavy cast iron.

The board deferred final action upon the matter until next Wednesday night.

DANGER FROM ELECTROLYSIS IN PIPES.

According to the President of the Water Board of Hartford, Conn., the most serious problem before the Board is electrolysis. As far as is known at present, the "disease" has affected only the water-pipes underneath the streets of the city, but it is thought likely that the gas-pipes may be attacked, and with serious results. Recently the board has been compelled to put new pipes in the place of some that were laid only eighteen months ago, and were badly eaten by the leakage of the electric current of the street car lines. The President of the Board suggests that the only way to prevent elestrolysis in the pipes it to have a return wire overhead which shall carry the current back, and thus avoid loss in the ground. He declares that the present method of bonding the rails and sending the current back in that way is not practicable.

D. F. Keefe, Watertown, Mass., is plumbing a large house in that city, using Cooper's Nautilus closets throughout.—Adv.

MORE THAN $1,000,000 PUT INTO NEW EDIFICES.

Huntsville, Ala., Jan. 4.—More thana million dollars have been expended in new buildings in Huntsville during the year 1900. Since last January there has been more building than in any other year in the history of the city. Among the new industries located are the Lowe Mill and the Huntsville Carriage Factory. The Merrimack Mill was completed during the year and the Dallas Mill was doubled, while work is about to begin on the construction of the Rowe Cotton Mill and the Madison Spinning Mill.

Numerous and handsome business blocks have been erected in the central portion of the city, among them the Jackson building, the Gadenrath block, the Strave-Dement building, Hutchens & Murdock's plumbing establishment, the Milligan block and the Strave Bros. block.

Real estate men and investors have had their hands full in erecting new houses for the accommodation of the growing population of the city and not less than 500 residences of all descriptions have been put up.

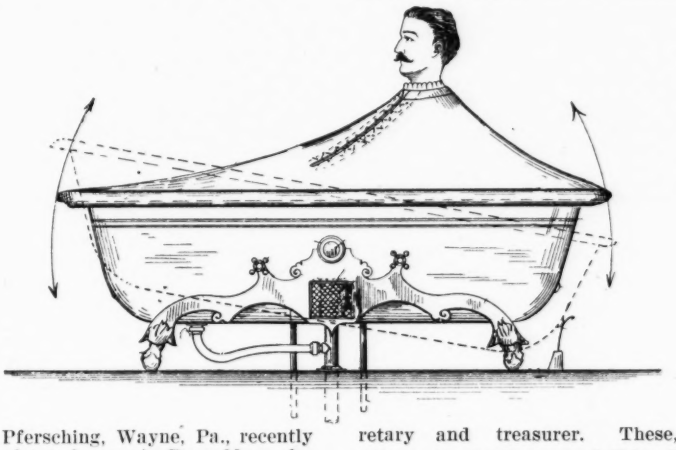
A. W. Hunter, North Adams, Mass., recently finished a large job of plumbing in the Richmond Hotel, using thirty of Cooper's Reno closets and other fixtures throughout.—Adv.

Never wears brassy
WHITE METAL CLEAR THROUGH
that's the whole story—
but it means that after once in the house it's there to stay!
No ripping out of the whole plumbing, because the tubing surface has been rubbed off, leaving it unsightly. "Benedict Nickel" Seamless Tubing may be rubbed forever,—it always remains silvery white.
253 BROADWAY, N. Y.
172 HIGH ST., BOSTON.
LAKE AND CLARK STS., CHICAGO.
BENEDICT & BURNHAM MFG CO
Waterbury Conn
V. WARING N.Y.

HOW IT IS DONE.

Salaried positions for learners is the title of a pamphlet issued by The International Correspondence Schools, Scranton, Pa. It tells how a young man can become a mechanical or electrical engineer or architect and support himself while learning. It contains photographs of a score or more students who have obtained better positions as a result of their studies and some specimen drawing plates showing the remarkable progress made by students.

G. Wilbur Thompson, of Newton Centre, Mass., is changing the plumbing fixtures in a residence in that city, putting in one of Cooper's Nautilus closets.—Adv.



J. G. Pfersching, Wayne, Pa., recently completed two houses in Bryn Mawr for Miss Helen eParson, using Cooper Brass Works' Reno closets, Special baths, lavatories, sinks and other goods complete throughout the two houses.—Adv.

TO MANUFACTURE A GOOD MANTLE.

All of the jobbing trade whose experience with mantles has not been the most satisfactory will be glad to know that a company has been organized in Chicago which proposes to turn out a first-class mantle. This concern is incorporated as the Harding Incandescent Company, with C. Knox Harding president and general manager. Mr. Harding has been for years identified with some of the principal lighting concerns of the country and has made a thorough study of the lighting business in all its phases.

For further particulars write the Harding Incandescent Co., Harding Building, Chicago.

To Enter the Market Soon.

The Iron City Sanitary Manufacturing Company is the name of a company which has just completed extensive works at Zelienople, Pa., and opened offices at 339 Fifth avenue, Pittsburg. The company have a capital stock of $100,000, all paid in, and are prepared to manufacture a full line of enameled baths and plumbers' sanitary supplies. They have patented a full line of specialties, which, together with their tubs, will be on the market February 1st. Their capacity is one hundred and forty tubs per day.

The following gentlemen are the officers of the firm: E. J. Frauenheim, president; Geo. Blackham, vice-president and superintendent; J. A. Frauenheim, secretary and treasurer. These, with Messrs. C. A. Fagan and Edw. Watson, will constitute the board of directors.

The company's new factory buildings in Zelienople are models of factory construction. They are five in number, operated entirely by electricity. The roofs have an interlining of two inch oak timbers and the floors are of hardened clay eighteen inches in depth.

We illustrate herewith a rocking or oscillating bath tub upon which they have secured letters patent and about which they are especially enthusiastic. This is designed to secure the exhilarating effect of the impost of waves of water—an effect which has a well known stimulating power. The bath may be electrically connected, thus securing a further remedial effect.

James Y. Deacon, Nantucket, Mass., is renovating a bath room in that town, using Cooper's Reno closet.—Adv.

HANDSOME QUARTERS.

Boston, Mass., Dec. 26.—The Boston National Aceylene Gas Co. have removed into handsome quarters at 179 Summer street, where they have ample office room, as well as more room for the display of their machines. This company has done a remarkable business the past year,and their machines have been well received by the public, now quite generally becoming acquainted with this brilliant and inexpensive gas.

A DAILY REMINDER.

The Ironsides Pottery Company, of Bordentown, N. J., manufacturers of sanitary earthenware, are the donors of a calendar for the new year which appeals to every lover of feminine beauty, the main feature being an exquisitely tinted picture of a winsome maid whose charming smile is quite beguiling. We understand that it is for free distribution. Suppose you write for it, not forgetting to mention "Domestic Engineering."

L. E. Smith, Gloucester, Mass., is renovating the plumbing in the summer residence of Mr. Knowles at Magnolia, Mass., using three of Cooper's Nautilus closets and other fixtures.—Adv.

The Wilks Mfg. Co., 53-55 South Clinton street, Chicago, are sending out a small folder giving the sizes, capacity and prices of their water heaters, steam generators and steel tanks. These tables should be kept at hand for ready reference. Write for them, mentioning "Domestic Engineering."

Jas. Tucker & Sons, Boston, are plumbing a fine residence in that city, using Cooper's Nautilus closets and other goods.—Adv.

TO MANUFACTURE BRASS GOODS.

Mr. S. P. Fisher for the past ten years, Mr. W. J. Schoenberger for seven years, and Mr. E. Rickersberg for five years connected with the Glauber Brass Mfg. Co., have associated themselves with Messrs. C. A. Stone and C. A. Stone, Jr., under the firm name of the United Brass Mfg. Co., with factory and offices at Cleveland, O.

They are manufacturing a complete line of plumbers high grade brass goods, including Perfect stop and waste cocks, noiseless fuller work, extra heavy compression work, extra heavy soldering nipples, etc. All their goods are thoroughly tested under high water pressure, and everything that they send out is guaranteed to be perfect in every respect.

A GLIMPSE OF NATURE.

Those who delight in the glory of the autumn woods should write to Hess, Snyder & Co., manufacturers of Boomer furnaces, etc., at Massilon, Ohio, for their elegant calender for 1901. Against a background of autumnal foliage are shown two splendid hunting dogs in the act of making a difficult point. The picture, which is rich in color, is from the celebrated painting by Edmund Osthaus. Doubtless they will find it in their hearts to send you one if you drop them a postal saying that you saw it in "Domestic Engineering."

James R. Gordon, Downingtown, Pa., recently installed Cooper's fixtures in the new bank building in that city.—Adv.

THE O. K. CLOSET.

This illustration shows a new low-down closet combination which is placed on the market by the O. K. Mfg. Co., of Ann Arbor, Mich. There are no iron trimmings on the inside of the tank to cause the discoloring of the water, and consequent discoloration of the closet bowl. The closet will rough in 12 inches, which shows that it is a very close-to-the-wall fixture. Tank is lined with 4-lb. sheet lead or heavy copper, as may be desired. Upon application, mentioning "Domestic Engineering," a copy of the advance sheets, illustrating this and some other types of closets, will be sent.

David Craig, of Boston, is plumbing a business block on Albany street, using Cooper's closets throughout.—Adv.

Thos. W. Weathered's Sons, 139-143 Centre street, New York City, send us their annual catalogue of heating apparatus for greenhouses, conservatories, dwellings, etc. This firm, which was established in 1859, has made a special study of green-houses, their heating and ventilation, and has valuable suggestions to offer to anyone who may have a greenhouse job on hand. To such they will send their catalogue free. Mention "Domestic Engineering" when you write.

Edward Whitfield, Greensburg, Pa., is fitting up a bath room in that city, using Cooper's fixtures.—Adv.

FOR THE YEAR 1901.

The Bailey-Farrell Manufacturing Co., plumbers' supplies, 619-621 Smithfield street, Pittsburg, Pa., send us an elegant pocket note book and diary for 1901 which is a marvel of compact usefulness. It is bound in sealskin with the name of the one to whom it is given stamped in gold letters upon the front cover. Inside the covers is a series of tables giving the weights of lead pipe, sheet and bar lead, weights and melting points of different metals, method of determining areas of circles and other short cuts in arithmetic and mensuration which will save the mechanic much figuring. Of a more general nature are the antidotes for poisons, help in case of accident, interest tables, postal information, etc. In the center of the booklet are sectional maps of the United States, with the population of the larger cities. Taken all in all it is a book well worth having, and as the edition must in the nature of things be somewhat limited we would advise you to write at once if you want one, not forgetting when you write to mention "Domestic Engineering."

Frank J. Eustace, of Philadelphia, is renovating the plumbing in the house of Mr. Wm. Powers, using Cooper's fixtures.—Adv.

"The Homes Successful" is the name of a persuasive booklet from the press of the American Radiator Company. The various devices for heating the house which have prevailed from an early day in the world's history are taken up and their strong and weak points noted, the sum of the matter being that in the hot water system of heating and ventilation the ideal of a healthful system has been perfected. Just why this should be so one must follow the argument of the book to understand. Suffice it that the argument is fair throughout. If you are not acquainted with the American radiators and Ideal boilers you owe it to your business to be enlightened. Write to the American Radiator Company, at Chicago, mentioning "Domestic Engineering."

The Genesee Automatic Closet Company, of Rochester, N. Y., send us a yellow book, dedicated to architects, physicians, health boards and others interested in sanitary appliances. Its forty odd pages are devoted to depicting and describing different patterns of the Genesee automatic flushing closet, a useful closet for public places where crowds of careless people have to be accommodated. Write for their yellow book, mentioning "Domestic Engineering."

A. L. Hersom, of Boston, is plumbing a large residence at Kendall Green, Mass., using Cooper's Nautilus closets, Special baths and other fixtures.—Adv.

One of the best expositions of the theory and practice of acetylene gas lighting that has come to the editor's table is a monograph being circulated by the Sunlight Gas Company, of 206-208 Greenwich street, New York City. The writer is evidently an enthusiast on this form of lighting, but he has the gift of communicating his enthusiasm. Incidentally he advances the claims of the company's "Submarine" generator. If interested, write to the company at the above address, mentioning "Domestic Engineering."

O. F. Clasby & Co., of Boston, are plumbing the People's Bank building, in that city, using Cooper's closets throughout.—Adv.

FOR THE PRESERVATION OF CASH.

The Dayton Supply Co., of Dayton, O., demonstrate the annual opening of their heart by sending to their friends and customers a little currency case with the kindly wish that a considerable number of Uncle Sam's bills will find permanent lodgment therein during the coming year. If you have not received one of these useful articles, they will doubtless be glad to send you one upon request, especially if you mention "Domestic Engineering."

P. Callan, Newark, N. J., recently completed the plumbing in the Newark Public Library building, using sixteen of Cooper's Nautilus closets, etc., throughout.—Adv.

Proposed Enlargement.

Sharon, Dec. 24.—(From a Staff Correspondent.)—At a meeting of the directors of the Sharon Steel Company to-day it was decided to increase the size of the tinplate mill to twice its present capacity. It is a ten-hot-mill plant, and with the additional mills will be of the same size as the Greer plant at New Castle.

In addition to this enlargement skelp and pipe mills will be erected with a capacity of 300 tons each a day. The skelp mill will roll steel from one-half inch in width to fifty inches. It will be built just west of the billet mill, so that the steel can be taken hot from the shears to be rolled. The pipe mill will be built in close proximity to the skelp mill, so that the output will not have to be transported any great distance to be worked into pipe.

This proposed enlargement means additional employment to 1,500 hands, making a total of 6,000 men who will be employed at the works of the company. Mr. Buhl, president of the Sharon Steel Company, said to-day: "We will need 3,000 new houses in Sharon within the next six months to accommodate our employes, and we are greatly worried over the outlook. We cannot start our works until these houses are built."

L. E. Smith, Gloucester, Mass., has three new bath rooms on hand in which he is using Cooper's Nautilus closets.—Adv.

Electric Heat Regulator.

Waterbury, Conn., Jan. 8.—The Waterbury Electric Company, of 48 Jefferson street, is becoming quite a factor among the large number of local business establishments. This company makes a specialty of an electric heat regulator for dwellings and offices, which is used either with steam, hot air or hot water furnaces, and regulates the fire automatically, preventing overheating of furnaces and maintaining a uniform temperature at all times. The thermostat is fastened on the wall and the regular motor attached to the furnace in the cellar. Both are connected by electric wires which are charged by three cell batteries, and working automatically, regulate the heat to the degree indicated by the thermostat.

C. F. Sullivan, Holyoke, Mass., has a nice bath room on hand in which he is installing Cooper's Reno closet, Marcellus bath, etc.—Adv.

"The Age of Specialism" is the third contribution to trade literature which the Climax Specialty Company, of Seneca Falls, New York, has sent out this year, showing that they are making a constant effort to keep abreast of the times. A feature of their business is the guarantee which they always send with their goods, thus insuring the buyer in his purchase. Their catalogue shows a large line of plumbers' specialties. Kindly mention "Domestic Engineering" when you write for it.

A Very Quiet, Modest Hustler.

Mr. O. Chan. Wells, one of our most prominent manufacturers' agents, located in room 10 of the Havemeyer building, New York City, is now representing the following manufacturers: The United States Tube and Iron Co., of Pittsburgh, Pa., who manufacture strictly wrought iron pipe, butt size; the South Chester Tube Co., of Chester, Pa., manufacturers of strictly wrought iron pipe in sizes 2 to 12 inches; the Michigan Brass and Iron Works, of Detroit, Mich., manufacturers of brass and iron gate valves, also steam and hot water radiator valves, unions, elbows, etc.; Standard Manufacturing Co., of Baltimore, Md., manufacturers of strictly wrought iron nipples and long screws; the Bostwick Steel Lath Co., of Niles, Ohio, manufacturers of conductor pipe, eave trough and metal lath; and the Manufacturers' and Producers' Supply Co., of Pittsburgh, Pa., oil well supplies.

To Cover a Big Field.

Mr. J. M. Dutton, who for the past three years has managed the wholesale plumbing department of Holley, Mason, Marks & Co., Spokane, has resigned his position with that firm, and after January 1st will call on the wholesale plumbing trade in the states of Oregon and Washington and in British Columbia in the interests of the various manufacturers represented on the Pacific Coast by E. A. Keithley of San Francisco. Mr. Dutton will be employed by Mr. Keithley as his assistant in the territory above mentioned, and judging from his past record and the strength of his new connections, his friends have nothing to predict for him but success.

Harry C. Worrell, Riverton, N. J., has some repair work on hand in which he is using one of Cooper's Nautilus closets.—Adv.

"5,000,000 Pounds Sold Annually" is the catch line on a private mailing card send out by the Philip Carey Mfg. Co., of Lockland, O. It refers to their asbestos furnace and stove lining cement. "Prices and information cheerfully given," is another line.

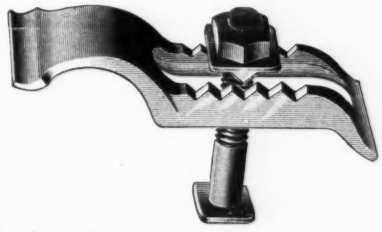
W. J. McGuire & Co., of Toronto, have some work on hand in that city in which they are installing six of Cooper's Nautilus closets with Atavic flushing valves.—Adv.

The Whole Year Slated.

Smith & Thayer Company, of Boston, Mass., take us back to the days of our childhood by sending us a miniature slate on which appears by months the calendar for the year 1901. A pocket in the back holds slates for each month in the year. The implication is, we suppose, that they are ready to slate orders every day throughout that period. Whatever their design, the calendar is certainly a pleasing desk ornament and a good advertisement of their celebrated Winchester heaters. You may have one for the asking if you mention "Domestic Engineering."

A "Never Slip" Basin Clamp.

The Wolverine Brass Works, Grand Rapids, Mich., make this basin clamp which is termed the "Never-Slip." It is



made of bronze and not of yellow cast brass, which they think is all the description it requires.

S. Faith & Co., of Philadelphia, have lately finished the plumbing of new offices and warehouses for J. P. Mathieu & Co., of that city, using Cooper's closets and other goods throughout.—Adv.

To Promote Providence.

The Ahrens & Ott Company, of Louisville, Ky., manufacturers of bath tubs and plumbing implements, presented over 300 of its employes with $1,000 life insurance policies on January 1st. Every employe was given a policy with the first premium paid up. The employes promised the members of the firm that they would not allow the policies to lapse.

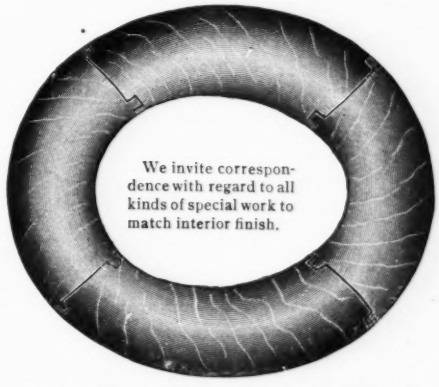
Install a Big Lighting Plant.

The Abner Acetylene Gas Company, of 36 La Salle street, Chicago, have installed two of their Abner Giant acetylene gas generators in the Academy of Our Lady, in one of Chicago's suburbs. Each generator is capable of supplying 1,000 acetylene burners, and the installation is in charge of one of the Sisters, who is said to be proud of the distinction.

Cowden & Zimmerman, Norristown, Pa., recently plumbed the residence of Mr. Wm. Sykes, of that city, using Cooper's Reno closets, Special baths, lavatories, sinks, etc., throughout.—Adv.

Fine Plumbers' Woodwork.

We show an illustration of the mitered seat joint as made by H. B. Olmstead & Co., 87 Frankfort St., New York City, makers of fine grades of plumbers' wood-



work. They will be glad to send prices upon application, and also wish the trade to bear in mind that they are large manufacturers of patterns for all kinds of work.

Clow Buys Walcott-Webster.

The event of the week in plumbing supply circles is the transfer by purchase of the Walcott-Webster Manufacturing Company to the well-known firm of James B. Clow & Sons. The latter firm has for some time felt the necessity for establishing a well equipped manufactory of brass and marble goods and has contemplated building such an establishment, but the opportunity offering itself to take over a well-established business, it was deemed expedient to do so, the terms of purchase having been agreed upon at a late hour Thursday evening last.

By these terms the Clow company secures by purchase the entire stock of merchandise, machinery, patterns, good will, and assets of every nature except accounts receivable. The Walcott-Webster Company will collect all outstanding accounts and pay all creditors.

The stock of merchandise now on hand will be removed to the warehouses of James B. Clow & Sons, while the manufacturing plant will be continued in its present location and materially enlarged. Although as it now stands it is a thoroughly equipped and efficient plant the improvements to be added will make it one of the largest and best in the country. It now comprises a finely equipped brass foundry, machine shop and factory for the turning out of all kinds of plumbers' brass goods, a plating plant and marble and slate works. Especial attention will hereafter be given to the manufacture of marble lavatories and work of a like character. The works will continue under the direct supervision of Mr. W. M. Webster, formerly president of the Walcott-Webster Company. All business will, of course, be transacted in the business office of James B. Clow & Sons, whose main offices are at Lake and Franklin streets, Chicago, with branches in New York and Havana.

The Walcott-Webster Company is, while of comparatively recent incorporation, well known to the trade through the personality of its leading spirits, Mr. W. M. Webster and the late Chester P. Walcott, both of whom grew up in the sanitary supply business and by strict attention to business rose from the ranks to places of prominence. Mr. Walcott, whose death occurred in the spring of 1899, was the first president of the company, which was incorporated October 11, 1897, Mr. Webster, as stated before, being his successor in that office.

Previous to his connection with the Walcott-Webster Company Mr. Webster had had many years of experience in the same line of work. His training began at the age of thirteen, at which time he began as an office boy in the employ of Rundle & Spence. From this position he advanced through the position of helper, salesman, collector, bookkeeper, traveling salesman and confidential employe. Subsequently he was connected with the L Wolff Manufacturing Company and the J. L. Mott Iron Works, in 1891 returning to the Rundle-Spence Manufacturing Company as general manager. In the same year he went into business for himself with Edward C. Smith.

Mr. Walcott, in like manner, was an old hand at the business, having, from the year 1877, held positions of trust in various supply and manufacturing houses as well as having made several ventures for himself. In 1889 he established with Edwin R. Hurlbut the firm of Walcott-Hurlbut Company.

The Walcott-Webster Company was the result of a consolidation of forces on the part of Smith & Webster and Walcott-Hurlbut Company, so that it will be seen that the firm through its various ramifications must have established long-standing connections and a prestige which will give to its successor a splendid groundwork on which to build. This, coupled with the well known enterprise and push of James B. Clow & Sons, ought to result in the establishment of an immense business in the lines now for the first time undertaken by that company.

An Important Change.

Blake & Andros, of 42 Oliver street, Boston, have decided upon an important change for the new year. Hereafter all heaters manufactured by them will bear the name "Crescent," instead of "Thayer," and the three styles will be designated as "Crescent Reliable," "Crescent Improved" and "Crescent Suffolk." This is done for the purpose of avoiding confusion with other heaters of the same name now on the market. The company lately succeeded to the business, trade, good will, patents, patterns and experience of the Thayer Heating Company, and while they believe the Thayer type of heater is among the most effective, they have themselves made changes and improvements which they wish to characterize under the new name of "Crescent."

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The handiest and best way to handle a pan is by the handle. The handiest and best route between the Pan-American Exposition and New York is the
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T.W. LEE, GEN'L PASSENGER AG'T.
B.D. CALDWELL, TRAFFIC MANAGER.
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Busy at New Quarters.

Waterbury, Conn., Jan. 10.—The Charles Thatcher Co. are now well settled in their fine new quarters on Center street and report a large amount of work on hand. Among other contracts are those for plumbing the house which the Seeley & Upham Co. are building at Ben Mohr for Mrs. Eva Gochie and alterations to the plumbing in a house on Field street for Mrs. William Knowles.

Hewitt & Thomas, Newton, Mass., are altering a bath room in that city, in which they are placing Cooper's Reno closets and other goods.—Adv.

Ready for Business.

The Franklin Foundry Co., 1155 S. Paulina street, Chicago, announce that in thirty days they will be ready to fill orders for soil pipe and fittings, as their soil pipe machinery was practically undamaged by their recent fire. They have been making very energetic efforts to get this branch in running order, in the meantime adding new patterns and other equipments.

A New Departure in Hot Water Heating.

The subject of heating water for domestic purposes economically has long been a problem for the plumber.

The Duffy Co., 317 W. 68th street, Chicago, believe they have solved the problem. They will place on the market in a few weeks a heating apparatus which is strictly a new departure in this line. The company will be pleased to furnish further information on request, providing you mention "Domestic Engineering."

Myers & Mahoney, Portland, Me., are renovating the plumbing in the private residence of a large manufacturer in that city, using Cooper's Nautilus closets.—Adv.

Have Hit a New Process.

The Globe Metal Co., 434 W. Lake St., Chicago, have discovered a new process by which they utilize the ashes from brass foundries. The brass obtained through this process is sold at very reasonable rates.

The matter will be of interest to brass manufacturers and will help them to realize a profit from what they have heretofore considered valueless.

Pierce & Cox, of Boston, are plumbing a business block on Lincoln street, that city, using Cooper's Brass Works' closets and other fixtures.—Adv.

After a Long Silence.

The Standard Sanitary Mfg. Co., of Pittsburg, Pa., send us a calendar for the new year which is unique and tasteful. The border, in dark gray matte sets off a photochrome picture of two old people who are all intent on a letter evidently just received from an absent son or daughter. It is a picture which grows upon one the more it is studied. The artistic merits of the calendar are not marred by obtrusive advertising. Doubtless they will send you one if you write, mentioning "Domestic Engineering."

An Educational Treatise.

Here's a catalogue that is more than a catalogue. It contains a treatise. If all manufacturers sent out catalogues that were as inviting in appearance, as readable in contents, as the new catalogue on the Webster System of Steam Circulation for Heating Purposes, just published by Warren Webster & Co., Camden, N. J., there would be less complaint on the part of catalogue users that the waste basket is the beginning and end of a customer's interest in such literature. This new catalogue of this well known firm is a fine piece of bookmaking, with artistic cover page in green and gold and a neutral tint, the inside printed on fine antique stock in two colors, with all the illustrations in genuine photogravure. We do not remember having seen a handsomer piece of printing. The contents, descriptive of the "Webster System," as it is known everywhere, are written in a clear, clean, forcible style, with very little technicalities, and reads as easily and is as entertaining as the talk of a clever salesman. We wonder sometimes, when we receive catalogues, why it is that so many of them are so bald and stilted. Surely the logical way to look at the catalogue question is to say that it is a silent salesman. Well dressed, informing, an easy-to-read and easy-to-remember talker. To our mind, at least, such is a good catalogue, and for these and other reasons that will appear readily to the man who reads the book, this Webster catalogue is a good piece of advertising. Every engineer or architect should have one, for it contains something new and strong on the heating problem. When you write for it be sure to mention "Domestic Engineering."

Over One Hundred Thousand in Use.

Philadelphia, Jan. 10.—The International Sprinkler Co. of this city is out with a pamphlet of merit. It deals with the question of fires and how to prevent them. They are in a first-class position to speak on this subject as over 100,000 International sprinklers are now in service and doing their duty night and day without rest. The great factories, mutual fire insurance companies by their records show that buildings equipped with approved automatic sprinklers suffer less than 10 per cent of the loss from which occurs in buildings not so protected. By installing International sprinklers which are the acme of all sprinklers on the market the greater part of the risk of fire, loss of property and loss of life will be banished from your home or factory. The small cost will surprise you. Theaters, hotels, factories and houses all over the country are being satisfactorily equipped with these sprinklers at a great saving to owners each year.

O.K.
CLOSETS.

No iron trimmings on inside of tank that will discolor closet bowl.

Closet will rough in 12 inches.

Iron pipe size, brass supply pipe.

Lined with Four Pound Sheet Lead or Heavy Copper.

The O. K. Manufacturing Co.
ANN ARBOR, MICH.

The United States Supply Co. of Omaha, Neb., send us their Twentieth Century Catalogue "A." The catalogue is well named, for its contents give one a very good idea of what the Twentieth Century house should be as regards sanitary appointments. The fore word tells of the wonderful strides made in sanitary science during the last quarter of the century and speaks modestly of the efforts of the firm to keep at the front of the procession, leaving the body of the catalogue to testify to their success in that direction. The catalogue will be sent free to those in the trade applying with a mention of "Domestic Engineering."

A New Gasoline Furnace.

Turner & Diener, 183 Lake street, Chicago, have placed on the market a new coil gasoline furnace especially adapted for plumbers' use, which has some very meritorious features. Their new catalogue will be sent on request if you don't forget to mention "Domestic Engineering."

James Y. Deacon, Nantucket, Mass., has some work on hand in New Bedford, in which he is using one of Cooper's Reno closets.—Adv.

The Perfect Gas Machine Co. of Rouses Point, N. Y., contributes a ten-page folder to the growing literature of acetylene gas lighting. It will be sent free to interested parties applying and mentioning "Domestic Engineering."

Music Hath Charms.

But not in a cold room, so says the new calendar which the Victor Heating Co., of 2295 Broadway, New York City, is sending to friends and patrons. The charming part of this truth is illustrated by a young couple who are diverting themselves with flute and harpsichord. Their dress is of the style of our grandparents and their surroundings are all of a day that is past. They look rather too comfortable to illustrate the need of modern heating apparatus, but were art consistent it would not be art.

John Cowley, of Pittsburg, has several fine jobs on hand in which he is using Cooper's low-down Nautilus closets.—Adv.

Brown & Wales, of 69-83 Purchase street, Boston, Mass., will send free to those who apply, making mention of "Domestic Engineering," a copy of their new catalogue of sanitary specialties and plumbers' supplies. This firm carries a large line of goods used by the up-to-date plumber.

Business Rushing.

The Herbert Boiler Co., 240 Root street, Chicago, Ill., report that they have been running their factory force day and night for the last five months in order to fill the orders for their popular water heater.

The Results of Many Experiments.

After five years of constant experimenting with acetylene gas generators the Cartolite Construction Co., 356 Dearborn St., Chicago, have placed on the market six generators, all of which have been passed by the board of underwriters. As safety is one of the most important points in the construction of acetylene generators, many will be interested to hear more from this concern. Full particulars will be sent on request, providing you mention D"omestic Engineering."

Wm. S. Cooper Brass Works made another big shipment of Nautilus closets to Germany during the past week. The jobbers in the Kaiser's country use these closets in large quantities.—Adv.

TRADE WANTS.

WANTED—A RELIABLE YOUNG MAN WHO can speak German and estimate plumbing and heating contracts. Address Robert Spice, Ft., Wayne, Indiana.

FOR SALE—PLUMBING BUSINESS IN GOOD Iowa town, good clean stock which will invoice at $2000.00. Best of reasons for selling. Terms cash. Address E. care of "Domestic Engineering" 58-64 N. Jefferson St., Chicago, Ill. t. f.

FOR SALE—CONTROLLING INTEREST IN A good heating and plumbing business in a western town of 25,000 inhabitants. Address "H.," care of Domestic Engineering, 58-64 N. Jefferson Street, Chicago. t. f. D.

FOR SALE—A FIRST CLASS PLUMBING AND heating business in a Nebraska town of ten thousand; established for fifteen years with work enough for at least six months in good contracts. Apply to J. M. care of "Domestic Engineering." 1-1901

Hot water or steam heat is no longer a luxury but a necessity. With it, cold, uncomfortable, dreary homes are made bright and pleasing. Of all the heaters made for this purpose, none has shown more efficient than the "Winchester," yet for all that, it is no higher than others of less merit. For prices write Smith & Thayer Company, Boston, Mass.

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Monthly Edition

The leading paper in the world devoted to
Plumbing, Heating, Lighting, Ventilating

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HERBERT T. SHERRIFF, Assistant Editor

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JANUARY 15, 1901.

THE FLUSHOMETER

Showing application of Flushometer.

The Kenney System
FOR FLUSHING WATER CLOSETS

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Endorsed by sanitary engineers and plumbers.

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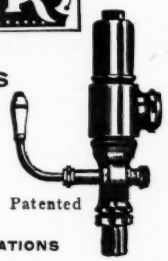
TRADE MARK



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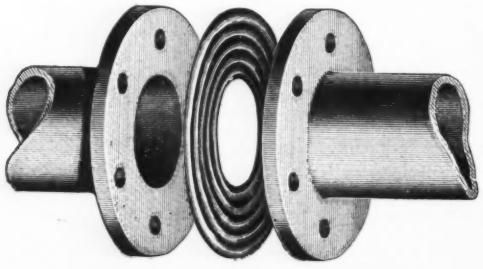

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MINERAL WOOL PIPE COVERING AND COPPER GASKETS

THEY SAVE STEAM AND MAKE ABSOLUTELY TIGHT JOINTS

BEST AND CHEAPEST
SAMPLES FREE

UNITED STATES MINERAL WOOL CO.
143 Liberty Street, NEW YORK.

December 28th, 1899

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STAMPED METER 150,000

25,145 Meters Sold in 1899.

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We stamp our Meters only as they are sold.

TRIMO PIPE TOOLS

All these tools are drop forged from steel. No others made so strong and durable. No expense spared to make the **best.** Give them a trial and be convinced.

Trimo Pipe Cutter Is convertible from a single wheel with rolls, into a three-wheel cutter, by substituting the two extra cutting wheels that accompany each tool, to be found in the handle, which is provided with a receptacle for same (see cut).

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and Other Goods
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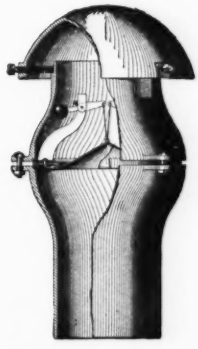

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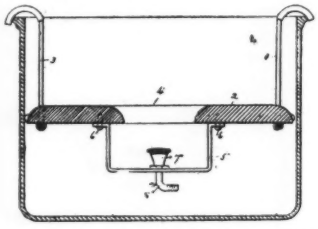
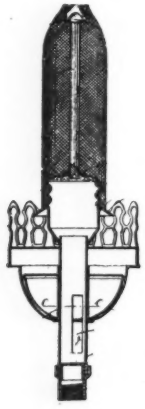
PATENTS AND INVENTIONS

The cuts illustrating patents and inventions in this department of Domestic Engineering are furnished by Oscar A. Michel, Solicitor and Registered Attorney for American and foreign patents, at 302 Broadway, New York City. Anybody desirous of having a patent or invention illustrated will please correspond with Mr. Michel regarding it.

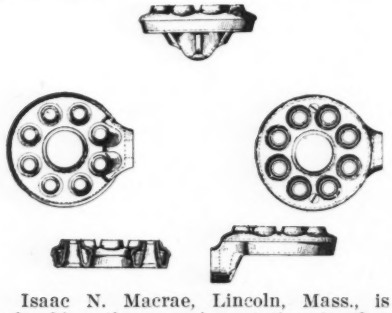
663,826. Combined Bath-Tub Seat and Bidet. Stephen D. Baker, New Haven, Conn., assignor to the Peck Bros. & Company, same place.



663,831. Gas Burner. Charles H. Frye, Buffalo, N. Y., assignor to himself and Arthur E. Jewell, same place.

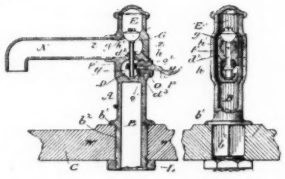


33,697. Heating Burner. Bernard A. Geurink, Cleveland, Ohio, assignor to The Schneider & Trenkamp Company, same place.

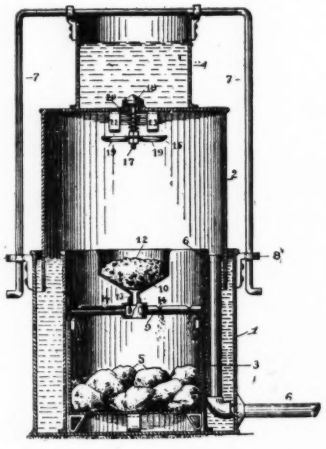


Isaac N. Macrae, Lincoln, Mass., is plumbing the pumping station in that town, using Cooper's Reno closets throughout.—Adv.

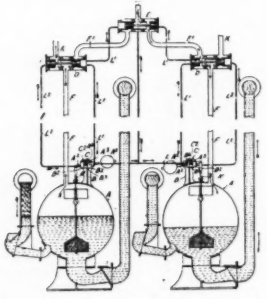
663,979. Faucet. Arthur O'Brien, Helena, Mont.



664,029. Acetylene-gas generator. Victor T. Weathers, Ione, Cal., assignor of two-thirds to David McCall, same place.

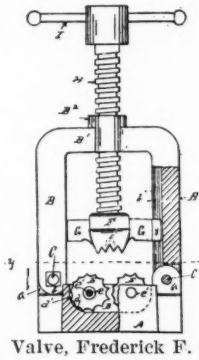


664,183. Ejector for raising sewage or other liquid. Isaac Shone and Edwin Ault, London, England.

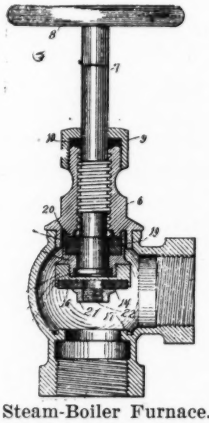


T. T. Rockett, of Philadelphia, is just finishing the plumbing of Dr. H. A. Lacey's new home in that city, using Cooper's closets, Special baths, lavatories, etc., throughout.—Adv.

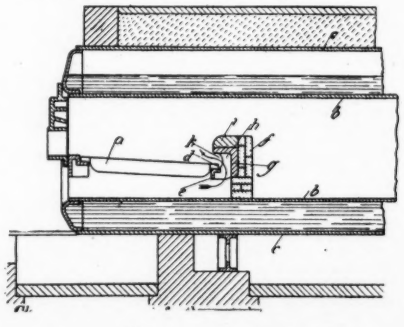
664,361. Pipe vise. Henry F. Renner, Erie, Pa., assignor to the Hollands Manufacturing Company, same place.



664,368. Valve, Frederick F. Grosse and William F. Lintz, Waukegan, Ill., assignors of one-third to Theodore H. Durst, same place.



664,473. Steam-Boiler Furnace. Christian W. Fleischmann, Nuremberg, and Karl Fischer, Sulzbach, Germany.



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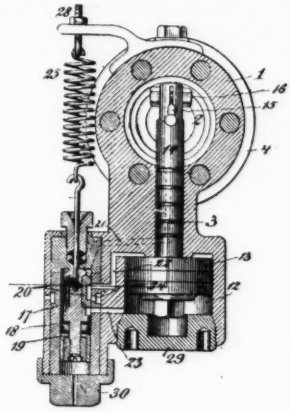
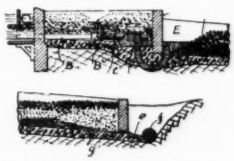
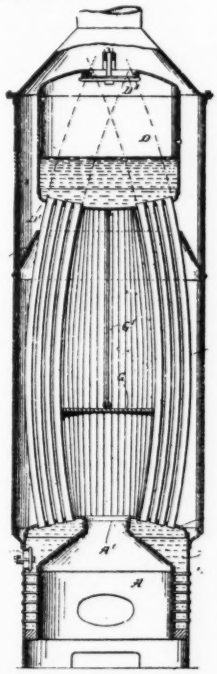
664,515. Reducing-Valve. John B. Waring, Newark, N. J., assignor of one-half to Hugh L. Fox, New York, N. Y.



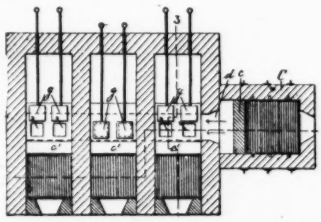
664,532. Sewage-Disposal Apparatus. William L. Church, New York, N. Y.



664,534. Boiler. Thomas P. Connelly, Jersey, City, N. J.



664,616. Subsidiary Furnace for Steam-Boilers. William J. Baldwin, New York, N. Y.



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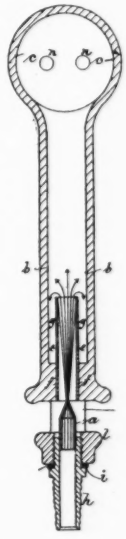
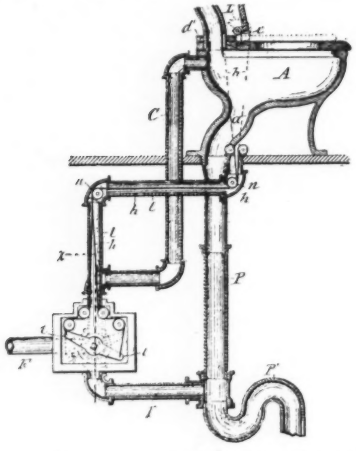
664,595. Acetylene-Gas Burner for Cooking-Stoves, Etc. Fritz Trendel, Berlin, Germany.



John H. Fitzgerald, of Boston, recently set two of Cooper's Nautilus closets in a large house in that city.—Adv.

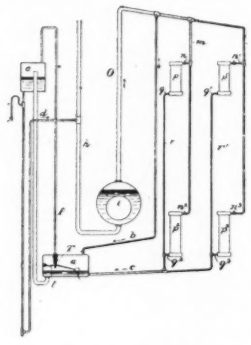
664,559. Water-Closet. Hiland H. Kendrick, Fulton, N. Y.



Isaac T. Hirst, of Philadelphia, set one of Cooper's closets in one of Mr. Chas. S. Heller's houses, in that city, during the past week.—Adv.

James Armstrong, of New York, has some good work on hand. He is using several of Cooper's Reno closets.—Adv.

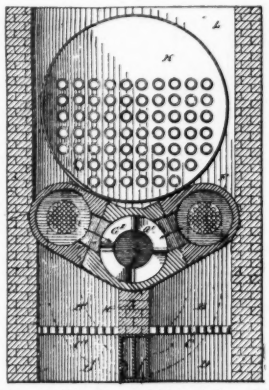
664,644. Low-Pressure Steam Heating Apparatus. Johannes Kelling, Vienna, Austria-Hungary.



Scholl & Semple, Youngstown, Ohio, are engaged on some good work at Sharon, Pa., in which they are using Cooper's Nautilus closets.—Adv.

R. G. Loughery, of Philadelphia, recently set one of Cooper's Reno closets in some work he had in that city.—Adv.

664,673. Furnace. John L. Peslin, Chicago, Ill.



664,782. Filtering Material. Eduard von Rittershausen, Vienna, Austria-Hungary.

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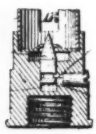
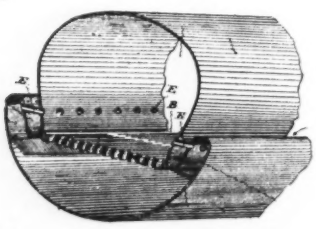
664,656. Adjustable Gas-Check. Thaddeus S. Leese, Allegheny, Pa.

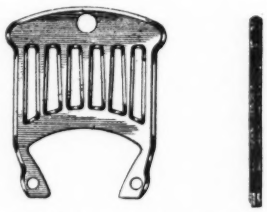


664,372. Smokeless Furnace for Steam-Boilers. Perkins H. Bagley, Alameda, Cal.

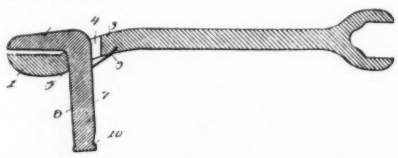


Stewart & Hayden, Burlington, Iowa, are making some repairs to the plumbing in the house of Mr. C. E. Perkins, using Cooper's Nautilus.—Adv.

33,785. Section for Steam-Boilers. Frank B. Howell, Detroit, Mich., assignor to the American Radiator Company, of New Jersey.

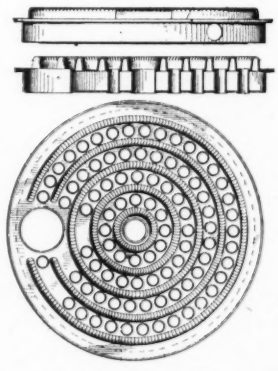


664,425. Pipe-Wrench. Nils Nilson, Absaraka, N. D.



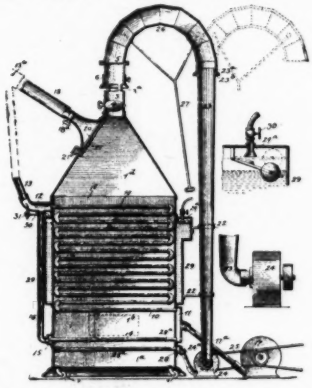
Goss Htg. & Plg. Co., of Kansas City, recently set one of Cooper's Nautilus closets in a fine house in that city.—Adv.

33,794. Gas-Burner. Rollin Henry White, Cleveland, Ohio, assignor to the White Sewing Machine Company, same place.

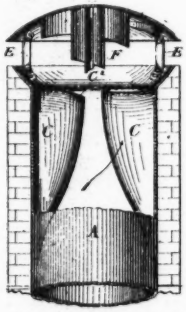


Harry Cunningham, Norristown, Pa., recently finished up some plumbing in the private residence of Mr. J. F. Ambler, in that city. The fixtures were those of Wm. S. Cooper Brass Works' manufacture.—Adv.

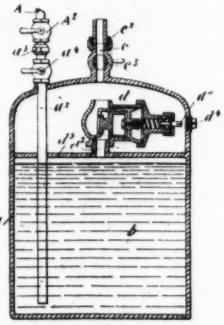
664,751. Portable Heater. James L. Hollingsworth, Newbern, Tenn.



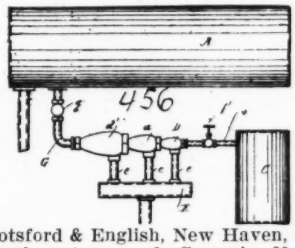
664,381. Smoke-Consuming and Fuel-Saving Device. Charles H. Bryant, Amandus C. Roessler, John M. Mitchell and Guillermo T. Augspurg, London, England.



664,383. Apparatus for Storing and Distributing Acetylene Gas. Georges M. A. Claude, St. Mande, and Georges A. Hess, Paris, France, assignors to Bruno Abdank-Abakanowicz, Parc St. Maur, France.

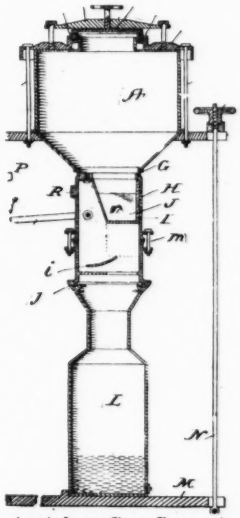


664,456. Boiler-Feeder. John Barry and Michael L. Shaughnessy, Westphalia, Kan.

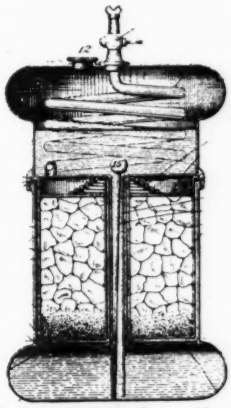


Botsford & English, New Haven, Conn., recently set one of Cooper's Nautilus closets in a large building in that city.—Adv.

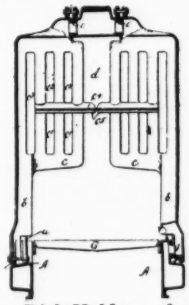
663,007. Acetylene-Gas Generator. Christopher M. Bridges, San Francisco, Cal.



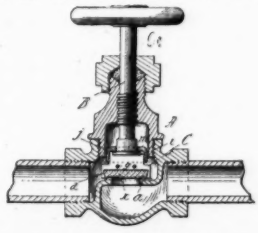
663,240. Acetylene-Gas Generator. Wolcott Remington, Windsor, Conn., assignor of one-half to Charles H. Cooley, Hartford, Conn.



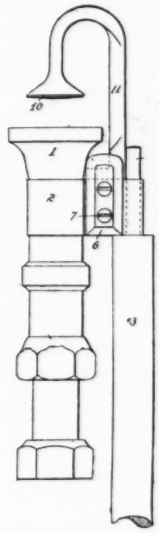
663,025. Sectional Boiler. Alexander T. Henderson, Reading, Pa.



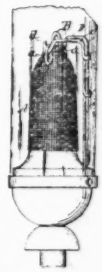
663,607. Disk-Holder for Valves. Michael E. Lynch, Elizabeth, N. J.



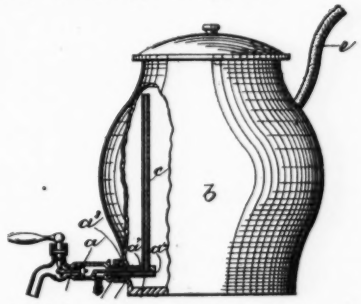
664,428. Lawn-Sprinkler. Augustus G. W. Peterson and John F. Haslam, Brockton, Mass.



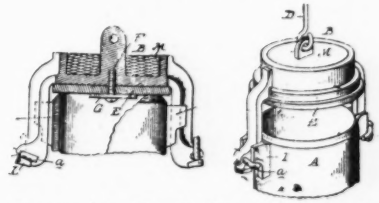
662,381. Mantle and Mantle-Support for Incandescent Gas-Lights. Max Herskovitz and Abraham T. Herskovitz, Chicago, Ill.



664,803. Combined Faucet and Overflow. Walter G. Wuichet, Dayton, Ohio, assignor to the Pasteur-Chemberland Filter Company, same plame.

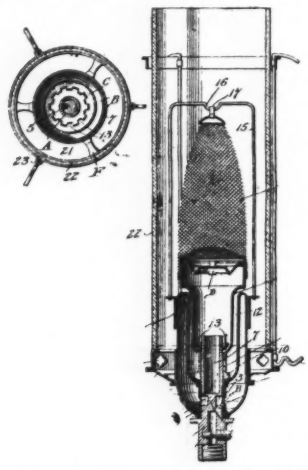


662,989. Valve. William Taylor, Detroit, Mich., assignor to the Ideal Manufacturing Company, same place.

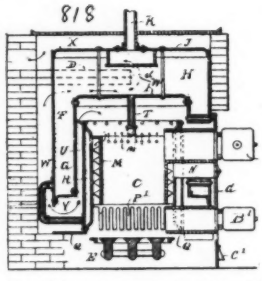


Korsmeyer Plg. & Htg. Co., Lincoln, Neb., have some repair work on hand in Nautilus closets.—Adv.

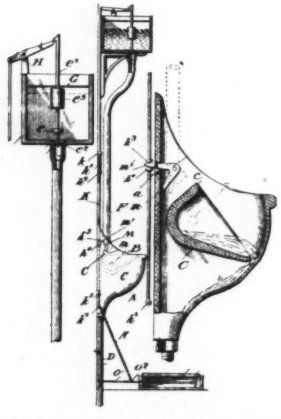
663,803. Incandescent Gas Burner. Charles A. Bluhm, Michigan City, Ind.



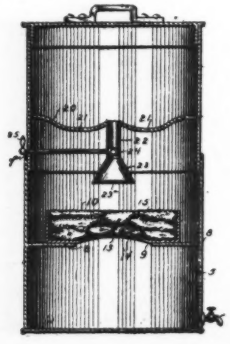
663,818. Boiler. Doctor F. Morgan, Chicago, Ill.



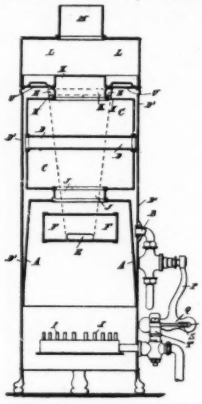
663,666. Urinal. Charles E. Richards, Boonville, N. Y.



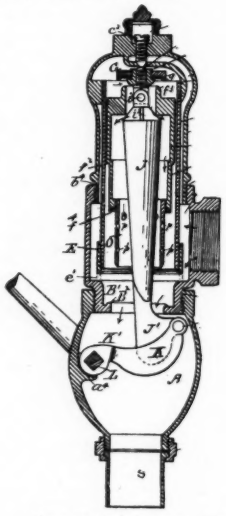
663,547. Water-Filter. Morgan B. Lemley, Delta, Iowa.



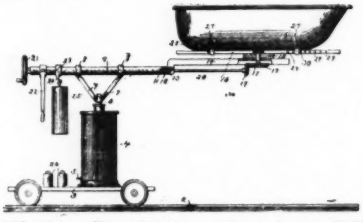
663,745. Geyser or Like Water-Heater. Henry T. Fenlon, London, England.



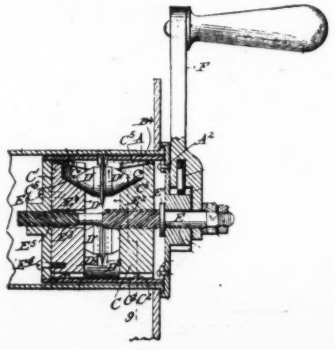
663,284. Flushing-Valve. Samuel W. Lewis, New York, N. Y., assignor to Geo. E. Gilchrist, Melrose, Mass.



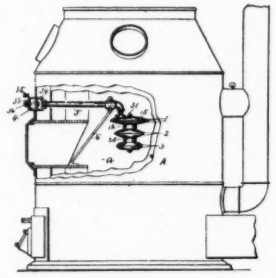
663,601. Apparatus for Enameling Bath-tubs. William C. Degelman, Mansfield, Ohio.



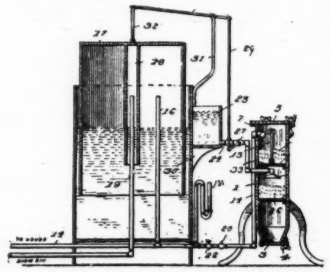
663,544. Pipe-Cutter. Joseph S. Hill, Los Angeles, Cal.



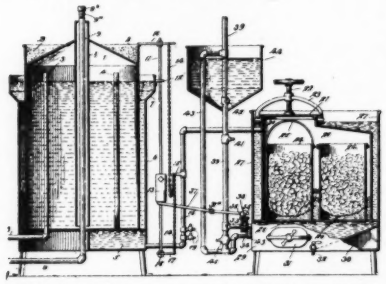
663,315. Apparatus for Producing Combustion. Leonidas D. West, Dundee, N. Y.



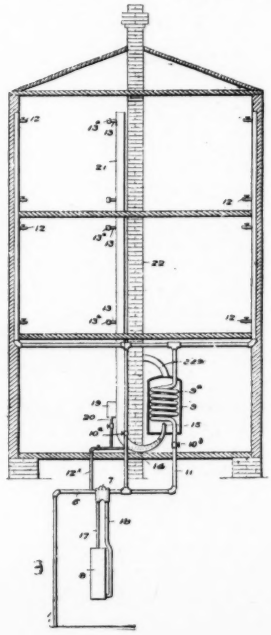
663,324. Acetylene-Gas Generator. Will F. Anson, Camden, N. Y.



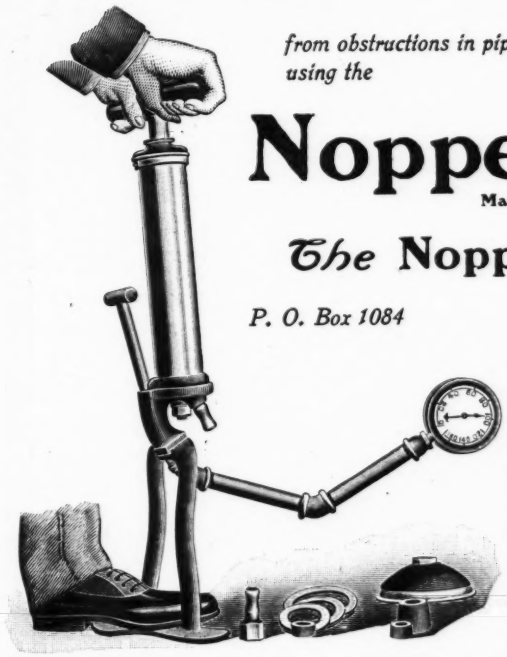
663,312. Acetylene-Gas Generator. Jas. Walton, Phoenicia, N. Y.



663,746. System of Ventilation, Heating and Cooling. Allen Fowler and Andrew J. Harpole, Union City, Tenn.



No More Trouble



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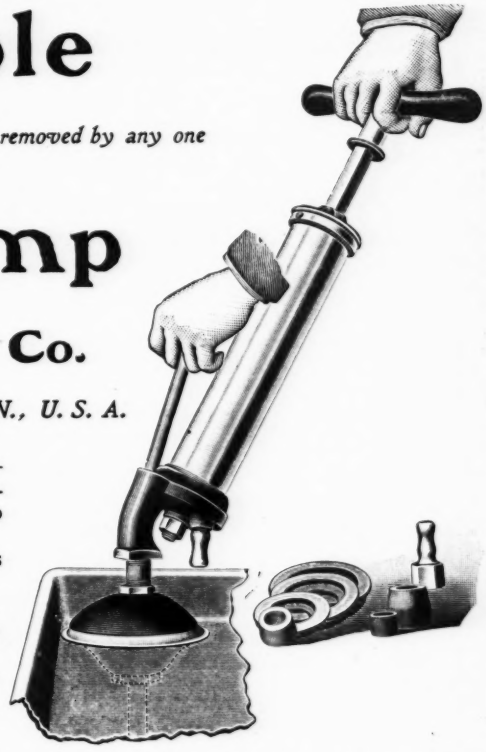
P. O. Box 1084 *HARTFORD, CONN., U. S. A.*

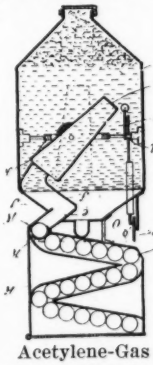


This pump is a Combination Lift, Force, Discharge and Test Pump and you can not only force air, liquid or gas into pipes, but can continue to do so, getting an ever increasing pressure. With no alteration in fittings or position of pump you can instantly change from force to suction and continue to exhaust air or draw out and discharge water and loose material. **No Other Pump has these Advantages.**

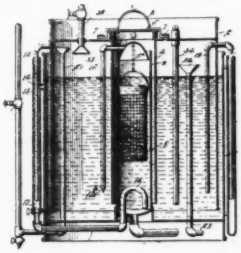
SEND FOR CIRCULAR

INDESTRUCTIBLE **SIMPLE IN CONSTRUCTION** **EASILY OPERATED**

662,546. Acetylene-Gas Generator. Chas. Puddefoot, Detroit, Mich.



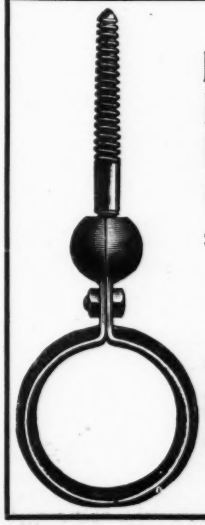
663,771. Acetylene-Gas Apparatus. Frederick Metzger, Hondo, Tex.



James Openshaw, Newport, R. I., is repairing the plumbing in a fine house in that city, using Cooper's Nautilus closet.—Adv.

A Pastoral Scene.

Wallace & Kennedy, sanitary plumbers, of Pittsburg, Pa., remember their friends with a calendar which is in every way charming. The garden plat of a cottage by the sea gives a sense of quiet and peace which is most restful to look upon. We congratulate this enterprising firm upon their choice of a calendar. One will not readily tire of such a scene.



Hanna Ball Joint Pipe Hanger

Simplest...Strongest

Made of Malleable Iron. All ways the best. Carried in stock and for sale by all Supply Houses

The Penn Engineering Co. 312 Cherry St. Philadelphia, Pa.

SCAIFE'S

Galvanized Iron Range Boilers.

Brazed Seams, Thoroughly Tested, Always Reliable.

Heavier, Stronger, More Durable Than Any Others.

Localities having Severe Pressures should use only the SCAIFE BOILERS; they cost no more than others. Hundreds set in place over twenty years ago are still in use.

Complete Catalogue Mailed Upon Application.

WM. B. SCAIFE & SONS,

(Established 1802)

PITTSBURGH, PA.

Announcement!

WE announce to the wholesale and retail plumbing trade that we are prepared to furnish a full and complete line of high grade porcelain enameled baths, lavatories, both single and sectional, sinks, all sizes, both regular and roll rim, laundry tubs, washout closets, syphon jet ranges, etc.

An entire new line of patterns has been constructed, enabling us to supply promptly not only enameled baths of the latest and most popular designs in all regular sizes, but an absolutely full line of plumbing goods of the most approved patterns.

Having had the advantage of becoming perfectly familiar with the best practice in enameled sanitary ware, and employing workmen highly skilled and thoroughly experienced in their respective lines, we are able to offer the trade an exceptionally complete line of goods of the latest pattern and of the best material and workmanship.

We desire to place especial emphasis upon the fact that our facilities are such that we can supply all the wants of the jobbing trade in the line of enameled ware, a thing heretofore impossible to all but the larger manufacturers.

Our catalog is now under way, and is being pushed to completion as rapidly as possible, and we will have advance sheets of the main lines ready for distribution shortly. In the meantime we invite correspondence and an inspection of our line of patterns and manufacturing facilities.

Champion Mfg. Company

Blairsville, Pa.

Notes from all Corners of the Field.

The Hood-Parks Nuptials.

Westfield, Mass., Jan. 2.—Daniel L. Hood, proprietor of the plumbing establishment on Main street, was married last Thursday evening at 6:30 o'clock to Miss Charlotte Emily Parks, daughter of Mr. and Mrs. O. B. Parks. The wedding was an unostentatious affair, with only the near relatives of the bride and groom in attendance. It was solemnized at the home of the bride, on North Elm street, by Rev. W. C. Gordon, of the Second Congregational Church. Mr. and Mrs. Hunt will live for the present at the home of the bride on North Elm street.

Big Contract Goes to Worcester.

Worcester, Mass.—Nicholas F. Deady, a Worcester plumber, has secured the contract to furnish the supplies and put in the plumbing work of the Natural food conservatory and institute buildings to be built at Niagara Falls, N. Y., by the Natural Food Co., of which Henry D. Perky, of Worcester, is president.

This is the largest contract for plumbing ever secured by a Worcester master plumber, and one of the largest ever let to a New England firm. It figures close to $50,000, which is twice as much money as the plumbing of the State Mutual building cost. The State Mutual building job was too large for any plumber in Worcester to handle, and a Chicago company secured the contract.

Will Propose Stringent Anti-Trust Law.

Terre Haute, Ind., Jan. 10.—Attorney-General Taylor in his biennial report to the legislature will make two recommendations that will attract much attention. One is for a law to prevent the sale of Indiana properties to trust companies and the other in regard to lynchings. The one piece of state legislation he asks is a law providing that if any corporation organized pursuant to a state law shall sell its property to any other corporation organized for the purpose of purchasing plants of like character, the object being to control or largely control the sale of such product, the sale of the property shall be void and the company shall forfeit its franchise and property to the state to be sold and its affairs wound up.

Know How to Enjoy Themselves.

Passaic, N. J., Dec. 29.—The Master Plumbers' Association of Passaic, held a crowning festival last night after the election of its officers at their annual meeting.

The officers were elected as follows: George Atgous, president; B. H. Slingerland, vice-president; Gustave Folsom, treasurer; Thomas R. Collins, secretary.

After the election they repaired to the new hotel of Captain Emmons on the river bank at the county bridge, and the bill of fare is so original and pertinent to the plumbers' craft, that it is inserted to show how the Passaic men join hands for their mutual benefit and agree to sup together not only, but to do good work at a fair price for fair men. Those who employ poor and worthless mechanics at "dog cheap prices" can only be expected to receive dog cheap work, they say, and they will not do work that is cheap and not only is dangerous but nasty. The menu began with the following: "Supper and decoctions prepared by Capt. S. H. Emmons," and it was preceded by a "stomach starter," then Blue Point "oysters on the half shell with swiped lumps and cocktails in glasses" "to wash down the lumps." Then roast turkey stuffed with oakum and olives with claret on the side, followed by chicken fricassee and celery and it is printed that small "ladles" are to be used. The craft will understand all these terms. Then came "roast pig with joints smugged and roasted on a hot blast furnace" suggestive of hot rum. Then the menu mentions potato and kickabove salads, and about this time we should think it was time to kick the table over, but Rhine wine followed, possibly to sober up upon, and "ice cream" served with "radiator and furnace trimmings," and the trimmings and ice cream were possibly Roman punch. Then came nuts, fruits and segars, S. T. brand, but this line on the card must have been a mistake of the printer, as the "S. T. Brand" should appear without the S. T. and with a "Y" at the end of "brand."

Henry W. Schroeder.

Henry W. Schroeder, a member of the sanitary staff of the board of health, died at his home, Summit and Bank streets, Newark, N. J., after a lingering illness.

Mr. Schreoeder was a plumbing expert, and was employed as inspector on sanitary work of the board of health for the last five years. His death was the indirect result of lead poisoning incurred several years ago. His blood became permanently affected, and he gradually wasted away. He was compelled to give up his official duties in November last.

Mr. Schroeder was a widower. He was 45 years old, and leaves one son.

An Elaborate Window Display.

Ann Arbor, Mich., Dec. 8.—(From a Staff Correspondent.)—Hutzel & Co. have arranged a fine bathroom in their show window. The rear and side wall are finished in adamant divided in squares, which gives it the appearance of tiling, and makes a beautiful wainscoting.

The floor is handsomely laid with Plicardo-Mosaic flexible tiling, specially designed by the Mosaic Tile Co.

The bath, closet and lavatory, with trimmings, are strictly high grade goods, manufactured by the L. Wolff Mfg. Co., and the entire display reflects great credit, and shows very well all the details of a first-class plumbing house.

Fort Worth Plumbers Strike.

Fort Worth, Tex., Jan. 1.—Twenty plumbers went out on strike this morning. Master plumbers were asked to sign an agreement effective today granting them $4 for eight hours' work. This was refused and a strike ensued. They had been receiving $3.50 for eight hours' work. The places of the strikers will be filled by non-union men.

Cincinnati's New Officers.

Cincinnati, O., Jan. 4.—Cincinnati Master Plumbers' Association held its annual election last night. Julius Hengstenberg was elected president; Martin Daly, vice-president; F. Kieserling, secretary; J. B. Laumann, treasurer; Thos. D. Lynn, sergeant-at-arms; board of directors, Richard Murphy, James A. Thompson and Frank Niecen.

Plumbers Demand an Increase.

Dallas, Tex., Jan. 1.—The union plumbers of Dallas today demanded an increase of wages from $3.50 to $4, and eight hours to constitute a day's work. President Harry Kahn of the union stated tonight that so far as he has learned none of the bosses have refused the demand and no strike is probable in this city. Reports from Fort Worth state that the same increase was asked for there and was refused, and that the plumbers of Fort Worth inaugurated a strike this morning.

The Dallas Strike.

Dallas, Tex., Jan. 7.—Mr. J. D. Kane, employing plumber, said today that the differences between the employers and the employes had not been adjusted and that he did not think an agrement could be reached upon the proposition last submitted by the men who refused to work unless the contract submitted by the plumbers' union was agreed to. He said that some of the employers had decided to make other arrangements for men and would not depend upon a probable settlement of the differences. He said that the vacancies were being rapidly filled and that there would be within a very short time between ten and fifteen plumbers here to take the places made vacant by the union men.

To Erect New Bath.

Baltimore, Md., Jan. 8.—The Free Public Bath Commission will soon begin the erection of a second building for free

baths. The present building on South High street has been crowded to its full capacity, and the additional building is expected to furnish similar facilities for another part of the city.

The new building will be located at the corner of Columbia avenue and Calendar alley, in Southwest Baltimore. The commission has purchased a lot there 40 feet by 100 feet, upon which a building almost exactly duplicating the High street building will be erected. The cost will be $25,000, and Mr. Henry Walters, who gave the money for the erection of the first building, will contribute the entire amount necessary for the establishment of the second.

A New Plumbers' Torch.

Joseph Bishop, of Meriden, Conn., has invented a substitute for the candle as used by plumbers in the shape of a gasoline lamp. It is perfectly non-leakable and can be carried upside down or in any position without the escape of the gasoline fumes.

The case of the new lamp is shaped like a candle and in using it the nuisance of the grease dropping is avoided, as it is impossible for any of the gasoline to escape except as it is burning.

All the local plumbers think the invention a fine one and Mr. Bishop has ordered fifty of the shells from the E. Miller Co. He will finish them in his work shop and if it develops as well as he thinks it will he will start in manufacturing them in large numbers.

The lamp is of about five candle power and he intends to fit some up with bases suitable for use in families for the purpose of going down cellar in the dark, etc. All who have seen the lamp are well pleased with it. Mr. Bishop will, in a few days, apply for a patent on it.

New Safety Gas Cock.

A safety gas cock has been patented recently by C. D. Anderson, of Providence, R. I., which is designed to lock automatically in whatever position it is turned to upon the removal of the fingers, thus avoiding the danger of turning the gas on again after it has been extinguished. It is described as follows:

The shell in which the plug is fitted is of the usual form. There are two stop notches on opposite sides of the edge of the opening, where the plug goes, and one side between the notches is cut away to form a double incline. A vertical hole is bored in the plug, and a horizontal oval hole is made through the plug in position to correspond with the notches in the shell when the plug is in its place. A pin slides freely in the vertical hole, and in this pin is another pin near the upper end; it occupies the oval hole and moves up and down in it. There is a mortise through the side of the handle or thumb piece of the plug into the vertical hole and a corresponding one through the sliding pin. A spring is fastened at its upper end in the plug, and its lower end is bent at an angle to enter the mortise in the shell and pin—and inclined upward at its end, so that when the spring is pressed in the bent end pushes one pin down and the other pin out of the notch. A small spiral spring is placed at the end of the pin in the oval hole, and held by a short screw to keep the pin up when not drawn down by the spring. The plug has a thread on its upper end and a nut with a spring washer between the nut and the shell. A pin prevents the loosening of the nut.

When all the parts are assembled one end of the horizontal pin is in one of the notches, and when the gas is turned on the spring is pressed down and moves the pin out of the notch, and the plug is turned. As the fingers are removed, the pins rise between the inclines. As the gas is shut off, the turning of the plug carries the pin up one of the inclines to a notch, into which the pin is raised by the spring. This holds the plug from being turned back, unless the spring in the handle is pressed, which cannot be done without the knowledge of the person operating the fixture.

Malden Plumbers Elect.

Malden, Mass., Jan. 5.—The Malden Plumbers' Union 145 has elected: President, W. P. Murphy; vice-president, E. J. Foisey; treasurer, Thomas J. Regan; recording secretary, M. T. Coakley; financial secretary, T. J. Cunningham; trustees, Peter Cassidy, Albert Deehan; sergeant-at-arms, Dennis Sullivan; directors, E. J. Foisey, William P. Murphy, Matthew T. Coakley, Thomas Cunningham.

Assistant Plumbing Inspectors.

Baltimore, Md., Jan. 3.—Health Commissioner Bosley yesterday announced the appointment of Messrs. George R. Minnick, Tenth ward, and Charles H. Indersieden, of the Seventeenth ward, to be assistant inspectors of plumbing, at a salary of $900 a year each. The positions are new ones, recently created with the consent of the board of estimates. Both appointees are "administration Democrats."

Wage Earners and Business.

It is an open secret here in the United States that the higher the wages and the more steady the employment of the laboring man, the greater is the prosperity of the country. Far above the patronage of the wealthy we have come to prize the patronage of workers' families for our local retail stores and even for the recreation enterprises represented by the capital invested in places of amusement and so forth. This is for the simple reason that not over 1 per cent of our people belongs to the wealthy classes.

It follows that the other 99 per cent, when well employed and well paid, present about ninety-nine times as many chances of furnishing a patron for a particular business as the wealthy class does. For it seems to be an universal trait in the American to dip into the good things of life as nearly to his fill as his purse will permit. It is this trait that causes the markets to respond so quickly for weal or for woe to the condition of the American laborer. America idle furnishes a dolorous contrast to American busy. A few years ago America was sadly idle, and sadly did American business recognize the fact. But one fine morning America concluded to go to work, and before the sun had reached high noon American business was booming as never before.

Let American business men see to it that American business booms. There is work enough here to go round, if properly distributed.—New York Commercial.

A Practical Man in His Line.

Connersville, Ind.—(From a Staff Correspondent.)—G. L. Huxtable, whose place of business is in the old Grand Hotel building, Fifth street, is a practicable business man and keeps in his employ experienced workmen. He makes it a rule to execute perfectly whatever he undertakes to do, and to conscientiously fulfil every contract he makes, which has had a tendency to steadily increase his business, and gain for him the confidence of his trade. Mr. Huxtable is a practical plumber, heating and sanitary engineer, and makes specialties of plumbing, steam, gas and water fitting, and deep well drilling. He has executed work in many of the public buildings and private residences of this city with entire satisfaction to all concerned.

Unions Will Combine.

Committees representing the Journeymen Plumbers' Union and the Independent Plumbers' Union have met and succeeded in reaching an understanding that will probably result in an amalgamation of the two bodies. The independent union is formed of workmen who seceded from the old organization some time ago and signed a working agreement with the bosses. Recommendations of the joint committee if adopted by the two organizations will be the means of bringing both bodies together and doing away with competition that has been going on for some time.

At a meeting of the Independent union the plan of amalgamation was unanimously accepted, and assurances are given that the old organization will take similar action. When the proposed plan is accepted by the old organization members of the seceding union will be taken back and arrangements made to secure a three-year agreement with the employers. Withdrawal from the Building Trades Council is booked to follow.

IF YOU KNEW

how good the **Tyden Filter** is, in connection with hydrant-supply, you would be using one now, yourself, and no sooner part with it than with your bathtub. You would also be putting them up in nice modern homes and making money on them at a lively rate. It's a good thing—the best article for the purpose and practical. Patented in U.S. and foreign countries. Send for our illustrated booklet, mailed free

METROPOLITAN FILTER COMPANY
97 WASHINGTON ST., CHICAGO.

REDFIELD'S Wrought Steel
Strong, Light and Pliable, Perfect Inner Circle Will not leak **Hose Clamps**
MANUFACTURED BY
J. R. CLANCY,
SYRACUSE, N. Y.

VALVES

of many kinds for many purposes, but all

GOOD

Our Catalogue will tell you

HERMANCE VALVE CO.
SYRACUSE, N. Y.

Sisson Insertable Joint
Indispensable to Plumbers
A friend in need is a friend indeed.
THE S. I. J.
FOR SOIL PIPE
Sizes 2 to 6 inches. Light and Heavy.
Makes a neat job and saves your patience.
ASK YOUR JOBBERS FOR IT

This does the trick.
MANUFACTURED BY
R. ESTABROOK'S SONS
SOUTH BOSTON, MASS.

McVAY & WALKER
Manufacturers of Enameled Tubs.

WILL GLADLY SEND PRICES ON THE TWO BEST TUBS MADE.

Write Today. *Unique and Eureka* **Prices will surprise you.**

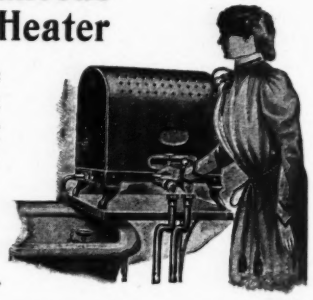
BRADDOCK, PA.

PLUMBERS' LEAD TRAPS

There are some pretty good reasons why plumbers should use The Western Brass Mfg. Company's Lead Traps, Bends and Ferrules, and why jobbers should handle them. Those who use and handle them know the reasons. Those who don't ought to. Better write right now.

The Western Brass Manufacturing Co.
615-617 WALNUT STREET, ST. LOUIS, MO.

The Victor Instantaneous Water Heater



is the cheapest, the most efficient and the neatest water heater made. It occupies but little space and is always ready, furnishing hot water in a few seconds, day or night.

The Victor received the highest award at the Omaha Exposition in 1898.
Write for descriptive circular, prices, discounts, etc.

W. J. ADAM....JOLIET, ILL.

HAVE YOU SEEN

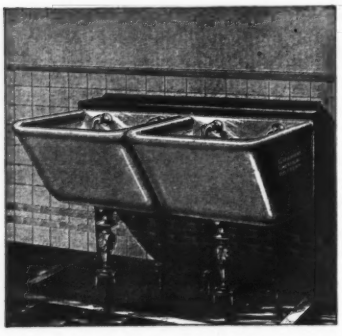
LAWSON'S

GAS WATER HEATER?

EFFICIENT, ECONOMICAL, COMPACT, MADE IN 3 SIZES.

Can be readily attached to an ordinary boiler at a very small cost.
Circulars gladly sent on application.

L. S. LAWSON, Mfg., 222 EIGHTH AVENUE HOMESTEAD, PA



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Good buyers want to know what that means. They may learn by asking for a catalogue of our imperishable Sanitary Laundry Trays and Sinks.

Chas. Graham Chemical Pottery Works

110, 132 Metropolitan Avenue
Brooklyn, New York

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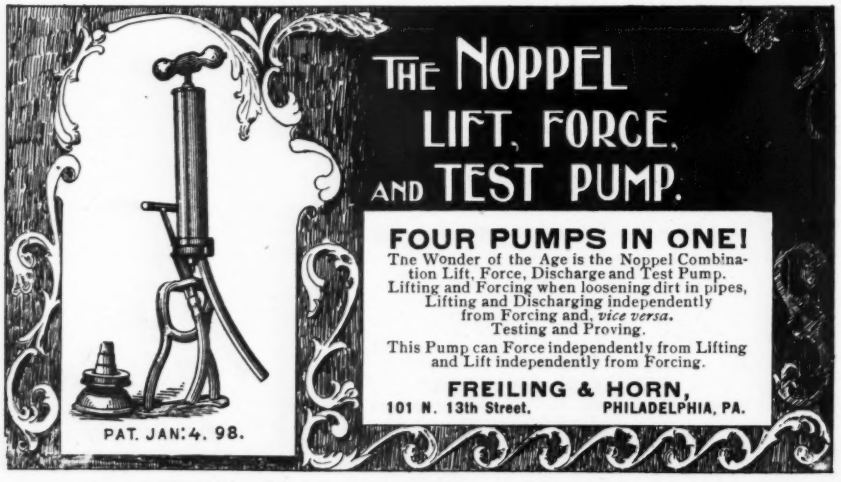
In the United States should have a NOPPEL PUMP


THE NOPPEL
LIFT, FORCE,
AND TEST PUMP.
FOUR PUMPS IN ONE!
The Wonder of the Age is the Noppel Combination Lift, Force, Discharge and Test Pump.
Lifting and Forcing when loosening dirt in pipes,
Lifting and Discharging independently from Forcing and, *vice versa*.
Testing and Proving.
This Pump can Force independently from Lifting and Lift independently from Forcing.
FREILING & HORN,
101 N. 13th Street. PHILADELPHIA, PA.
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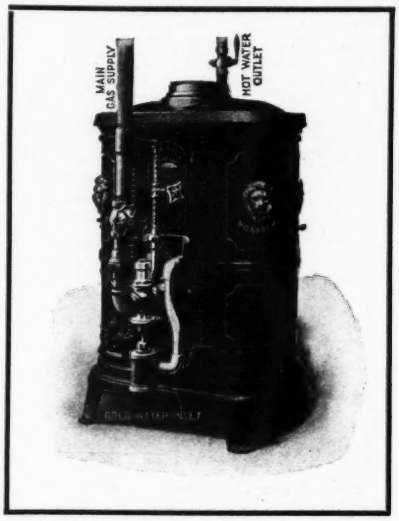
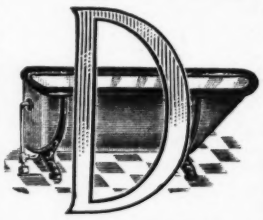
"MONARCH" LEADS



The "MONARCH" Automatic Instantaneous Water Heater, is the first and the best; in fact 'tis the "survival of the fittest".
Send for Catalog fully illustrated and you will be convinced.

MONARCH WATER HEATER CO.,
306 Wood St. Pittsburg
Robert B. Caverly, 504-506 Tenth St., Washington, D. C.



DAY Sanitary BATH TUBS...

We originated STEEL, ENAMEL AND STEEL CLAD BATHS, and claim superiority over all others. Our new list is out, shall we send you one?

DAY METALLIC MFG. CO., Detroit, Mich.

The GENESEE No. 10

Frost Proof Automatic Water Closet

For outside locations where other closets will freeze. Perfectly frost proof in zero weather. Tank and pipes always empty except when closet is in actual use. Cannot be used without discharging itself; no water left above frost line.

Ask for catalogue of other goods.

Genesee Automatic Closet Co.
ROCHESTER, N. Y.

OAKUM PACKING AND ROPE

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335 Carroll St. BROOKLYN, N. Y.

THEORY AND PRACTICE OF

LEAD BURNING

By the Autogenous Process

OR HOW TO SOLDER WITHOUT SOLDER

With full instructions to the amateur in the details of the machine and the management of the gases, with valuable suggestions and directions for practice

BY AN EXPERT

Every Plumber Should Have This Book

PRICE, BY MAIL, $1.00

Domestic Engineering, Chicago

Put it down in Black and White the

MONON ROUTE

IS THE DIRECT LINE BETWEEN

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"TOTAL ECLIPSE"

Hydrants and Street Washers

The cheapest and most durable on the market.

Guaranteed to give entire satisfaction

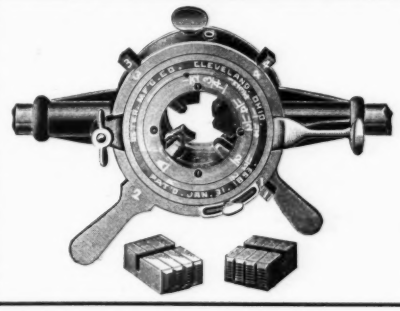
We also make all styles of "McNAMARA" PATTERN HYDRANTS

Carried in stock by all Jobbers

WRITE YOUR DEALER FOR PRICES

JOHN G. KUPFERLE

ST. LOUIS



Steel pipe is easily and accurately threaded with our modern tools

The Oster Mfg. Co.

8 East Prospect Street, Cleveland, Ohio

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WE GIVE YOU WHAT YOU WANT WHEN YOU WANT IT AND AT THE RIGHT PRICE

YOU ARE THINKING of what you may need at this season of the year.

SUGGESTIONS Plumbers' Torches, Thawing Steamers, Closet Repair Connections, Plumbers' Furnaces, Steam hose, etc., etc.

MAY WE SUPPLY YOUR WANTS?

WE HANDLE EVERYTHING IN PLUMBING, GAS, STEAM AND WATER SUPPLIES

Have you our Catalogue, Memorandum Book and Calendar?

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National Enameled Iron Jail Closet

Simple, durable and easily adjusted. No overhead tanks required. Cannot be tampered with—no movable parts being exposed.

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TOLEDO, OHIO

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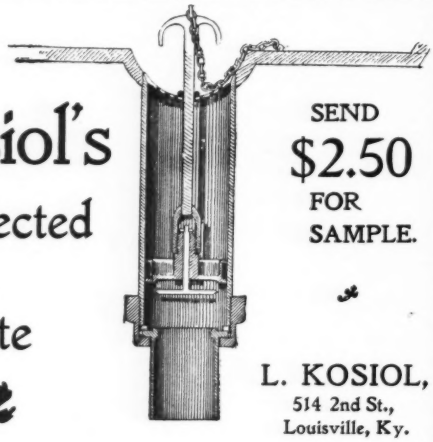

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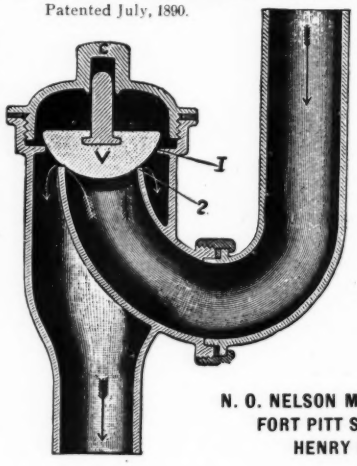
Patented July, 1890.



Seal: Cannot be reduced in any degree by most severe syphonic action.

Evaporation: Ball rests in such a way that it is impossible for water to evaporate.

Back pressure: Positively safe against it.

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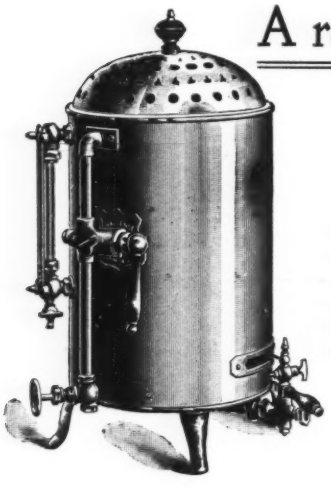
A record breaker



Boils water in 1½ minutes

This heater with gas attachments for heating water to a high temperature with unequal rapidity and economy cannot be surpassed by any heater on the market. Adapted for bath rooms, etc. Send for catalog.

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IRON PIPE, FITTINGS AND VALVES
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CAST-IRON SOIL PIPE
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IMPROVED BATH-ROOM FIXTURES

"The Thrush, enrapturing heaven and earth."

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SYPHON
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We have others.

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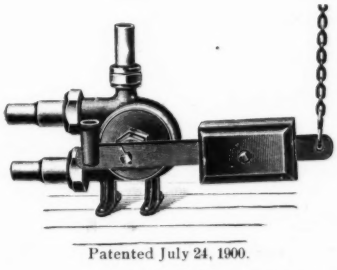

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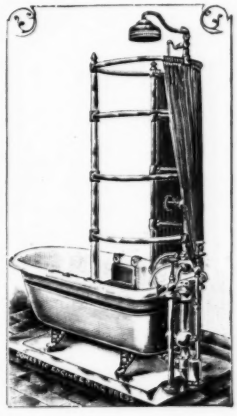

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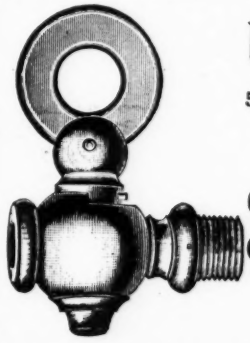
Balls, Bodies, Binding Posts, Pushings, Caps, Cocks, Nozzles, Gas Stove Fittings, Nipples, Swings, Screws, Nuts, Wire Connectors Electrical Goods, Etc., Etc. SPECIAL TURNING TO ORDER.



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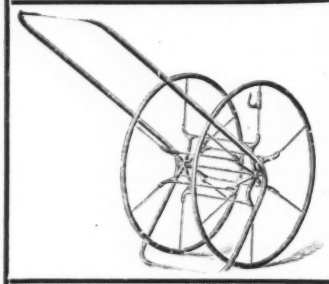
WIRT'S ALL IRON HOSE REELS



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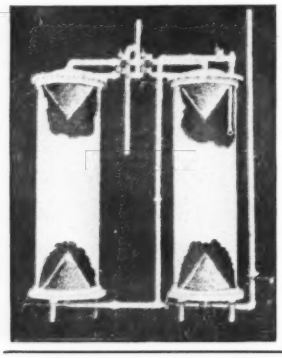
THE ECLIPSE DUPLEX FILTER



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No Alum or Coagulent used for Clarifying

Send for catalogue and hundreds of references on the best filter made in the U. S.

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Patented Sept. 24th, 1889.

SAVES TEN TIMES ITS COST EVERY MONTH.

This device is a **Specially Shaped Spiral Spring**, made from **Crucible Steel** wound tapering to one end so as to be easily withdrawn, and having a loop at the other to hook into when the bend is to be made in a long piece of pipe.

The Bender, placed inside of the pipe, supports and prevents the pipe from flattening or collapsing while being bent. By the use of it lead pipe, and copper, brass or steel seamless tubing may be quickly and easily bent. It is as easy to form opposite or double curves, such as goose necks, as a single bend.

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ROOF FLANGE

No. 1 will adjust from ¼ pitch to ½ pitch
No. 2. will adjust from flat to ½ pitch

Made for Standard and Extra Heavy Pipe in copper and Galvanized Iron. Only two sizes to be carried in stock as the adjustments fit all angles.

For Prices, etc., apply to

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Cooper's Adjustable Drain Trap

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Vanderman's Adjustable Fitting for Connecting Soil Pipe

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Freight allowed on the Adjustable Fittings, East of the Mississippi river, on a dozen of one or assorted sizes.

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THE WILHELMI | THE MODERN

two best boilers

The "Wilhelmi" is a high grade copper range boiler tested to 250 lbs. There can be no better boiler made : : : : : :

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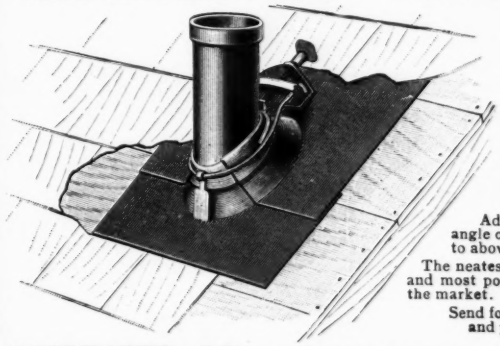

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Adjustable to any angle of roof from flat to above 45 degrees.

The neatest, most unique and most popular flange on the market.

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Has reversible seat made of Bronze Metal.

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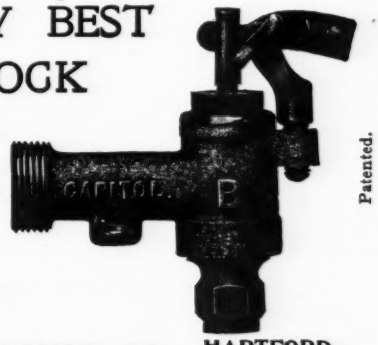

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THE "CLIMAX" Rubber Adjustable Elbow.

SIMPLICITY AND PERFECTION.

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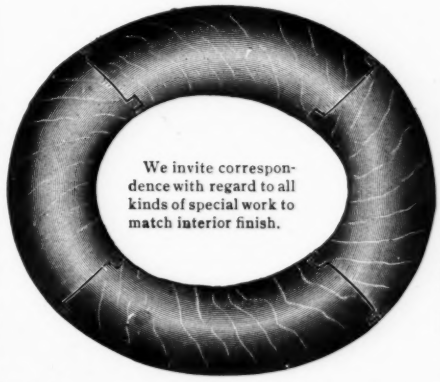

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We make special orders in all fancy woods, such as Mahogany, Bird's Eye Maple, Sycamore, Black Walnut, etc.

We make drain boards in a superior manner, and invite sample orders.

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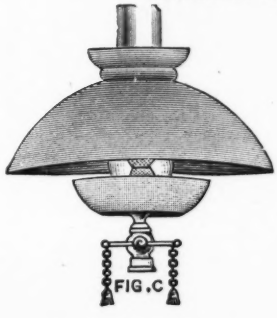
GIVES A FLOOD OF LIGHT



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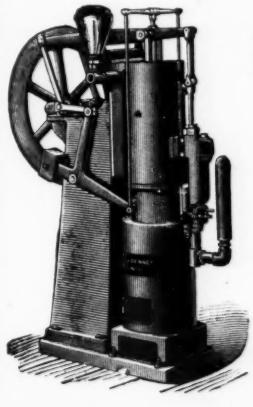

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Embody the very latest Improvements in Design and Construction.

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Perfectly Safe, Noiseless,
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Built for years by

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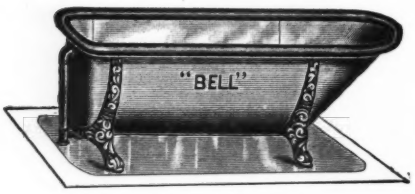

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Bi-metallic specialties
Lead traps and bends

Write for prices

Lead pipe, sheet lead
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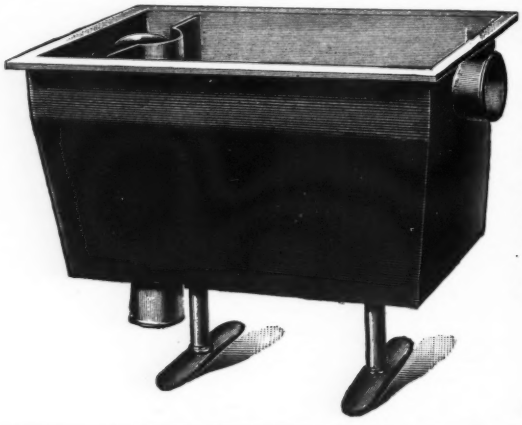
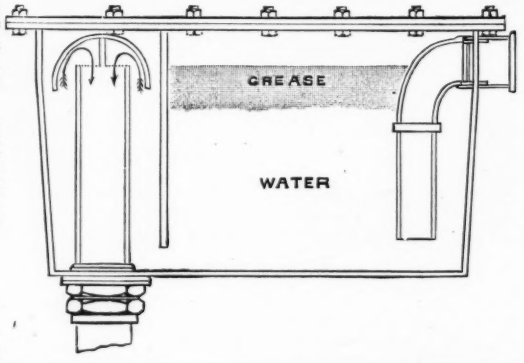


Only Mechanical Grease Trap

on the Market that will catch every ounce of grease

Only Grease Trap that can be easily taken apart and thoroughly cleaned.

Only Grease Trap containing an inside trap for quick action and removing of contents when desired. Connecting pipes may be increased or reduced from 1½ to 4 inches. Many other superior points will be advanced upon request.



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Better by far to be sure than sorry.

The best is none too good for your customers

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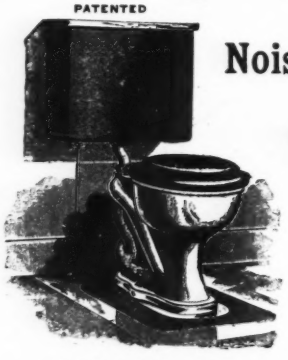

Plate C 50. Siphon Jet.
NOT HIGH PRICED, BUT HIGH QUALITY

Noiseless "Guaranteed" Powerful

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THIS STANDS FOR THE BEST.

MONEY, BRAINS AND EXPERIENCE CAN PRODUCE NONE BETTER

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A LOW DOWN WASH DOWN FOR A WAY DOWN PRICE

THE I. S. C. BALL-COCK

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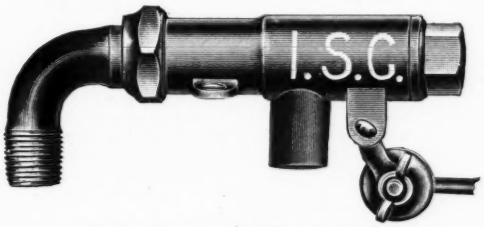

Sizes ½ inch to 4 inches in stock.

OVER A MILLION IN USE.

Valve is balanced.
Will not hammer even under pulsations of a pump.
Has renewable seat of best steam metal.
Is perfectly noiseless.
Full sized area.
Good in any place for high or low pressure.

GUARANTEED

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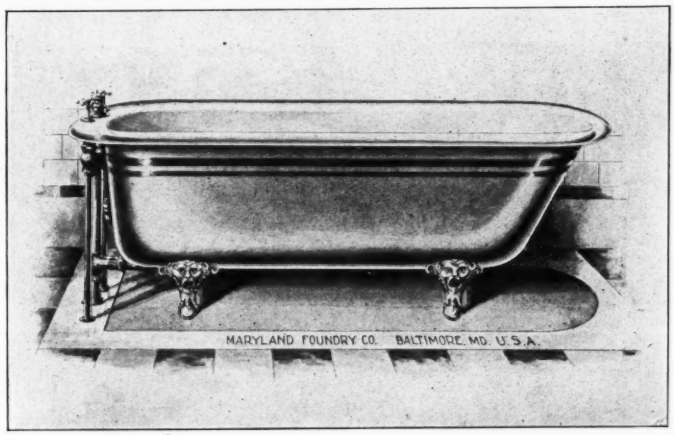
TRY OUR GOLDEN OAK FINISH



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Pattern Maryland Enameled Bath is but one of the elegant line of baths made by us for the trade who desire particularly fine goods at the same price as other companies charge for run of foundry goods. Our catalogue shows other styles.

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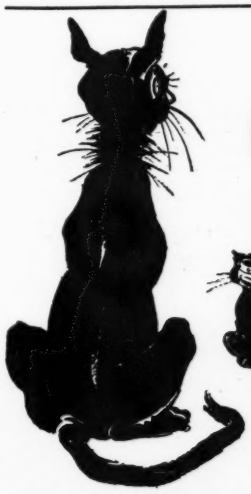

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AT REASONABLE PRICES, WRITE TO

FLECK BROS.

44 N. Fifth Street Philadelphia, Pa.

FULL LINE OF
FINE PLUMBING GOODS

Accessible Sewer Flushing Fittings.

Flushing Clean-out Trap.

Four Way Cleanout and Branch.

Straightway Backwater Gate.

Resist sewer or back-water pressure; location of sewers always known and accessible without disturbing floors or concrete; each fitting has iron inspection manhole to surface, with tight but removable cover; flushed by hose or may be connected to main water supply.

Made for either iron or clay pipes. Back-water gates may be attached preventing flooding of cellars. Can you imagine anything better?

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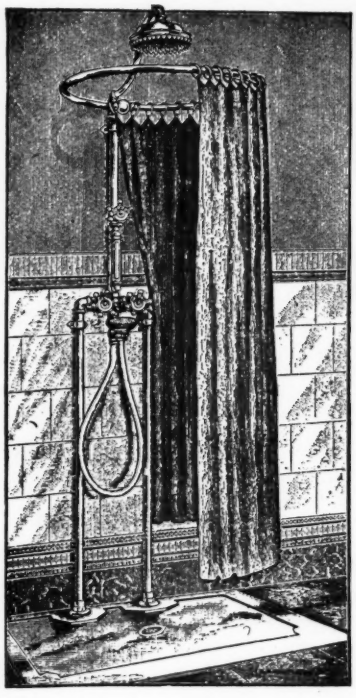

Special prices to the trade on Shower and Needle Baths and Shampoo Fixtures in a large variety of our own manufacture.

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Also manufacturers of an extensive line of special designs in brass work for lavatories, bath tubs, sinks, etc. Brass work in a large variety for marble and slate closet and urinal stalls.

THE GENUINE

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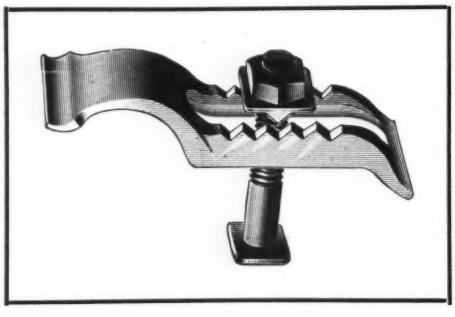

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Enough said!

Manufactured only by

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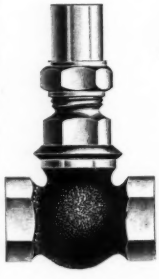

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never jumps to
EXTREMES.

HAYS LOCK SHIELD VALVES

HAVE NO
FANCIFUL
CHANGES
BUT ARE
PLAIN
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The right thing every time.

Write us for information on anything in the
GAS GOODS LINE.

Hays Manufacturing Co.

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You May Need Your Money!!!

Don't buy 3 Pumps when one will do the work.

THE

PERKES

Patent Combination Air, Force and Test Pump.

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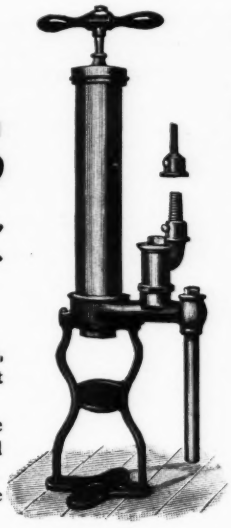

Will test soil pipe, prove gas pipe, and there is no force pump made that is its equal.

No stuffing boxes; all valves are on the outside and work equally well with air or water.

Our circular will tell you of the other good points.

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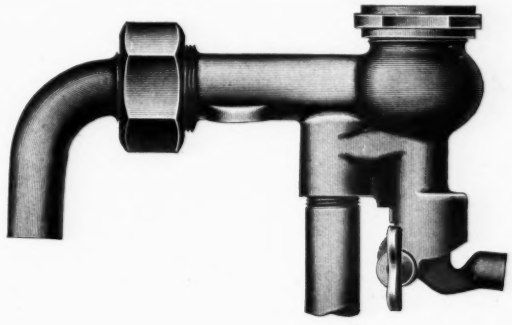

The Duplex Ball Cock

GUARANTEED TO OPERATE ON ANY PRESSURE FROM ONE POUND TO THREE HUNDRED POUNDS. MADE FOR TOP, BOTTOM AND END SUPPLY. FOURTEEN SIZES AND STYLES.

A Postal will bring you Price List and Discounts

F. W. WEBB MFG. CO.

52 to 60 Elm Street, 2 to 24 Friend Street, Boston, Mass.

YOU WANT THIS!

As you have been looking for it these many years.

The Xntric Ball Cock

For High or Low Pressure

Notice size of Ball. It is only 3½ inches

Practically noiseless. Guaranteed for two years. There is positively no hammering, and the only one on the market where the valve is closed by water pressure, and which obviates all danger of accident. Been on the market and heartily approved for three years. For use with hot or cold water.

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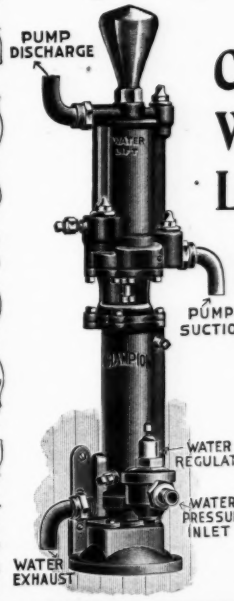
THE CHAMPION WATER LIFT

IT PAYS

TO PUT IN THE

CHAMPION WATER LIFT



For pumping cistern water or for increasing city pressure it is the BEST.

IT WORKS PERFECTLY. That is our guarantee, and our name is guarantee that the construction is right. Handled by all large jobbers. Write for catalog.

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All first class Plumbers
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New Style
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NO EXPOSED SURFACES, EASILY KEPT CLEAN
THE BROUGHTON SELF-CLOSING BIBBS & COCKS HAVE BEEN ON THE MARKET SEVERAL YEARS - SUPERIOR TO ALL OTHERS FOR SIMPLICITY AND STRENGTH - EVERY ONE WARRANTED.
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Did you ever hear of the LYONS' COCKS? Why, of course you did. Everybody is using them now.

You can change 'em around, or use any kind of a handle. If you haven't used them, you don't know how good they are.

THEY ARE MADE OF ENTIRELY NEW, TOUGH METAL

WE DON'T NEED TO SAY THAT THEY NEVER LEAK BECAUSE THEY NEVER DO.

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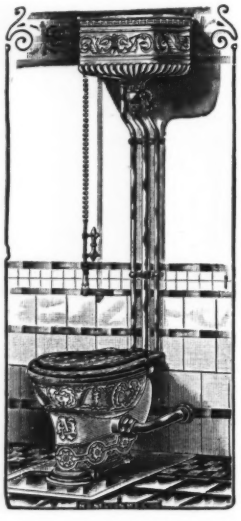
SOLE MANUFACTURERS, CLEVELAND, O

PLUMBERS' SUPPLIES



Nelson Syphonia Water Closet

Pneumatic syphon

PRICE REDUCED
QUALITY RAISED

N. O. NELSON MFG. CO., SAINT LOUIS

J. B. CAMPBELL

Brass Works

Brass and Iron Goods for Water and Gas Connections. Plumbers' Supplies.

Office and Works: 16th and Cameron Sts

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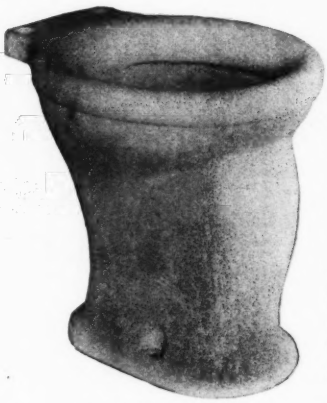


No. 1. Plain Washdown

This cut represents our new improved plain wash down, which is made with walls one inch thick insuring unusual strength, thereby reducing liability of breakage to a minimum; it is therefore particularly adapted for public buildings, schools or any public place where closets are subjected to hard usage, and is designed to take the place of imported or domestic fire clay closets, and being constructed of a hard vitreous china body it is guaranteed against crazing. We can also furnish these closets with syphonic action or syphon jet.

We manufacture everything in the sanitary earthenware line and pay particular attention to specialties. All closets being tested before leaving our works, we guarantee their working qualities.

Bellmark Pottery Co.

P. O. Box 547. TRENTON, N. J.

THE REX.

THE

KING

of them all.

Syphon Hopper and Trap Combined.

Surpassed by no Closet on the Market.

This closet has **full water ways** through all the **syphon pipes, a large water surface** and 3 inch Seal. It is made for high or low tank. Embossed or plain surface.

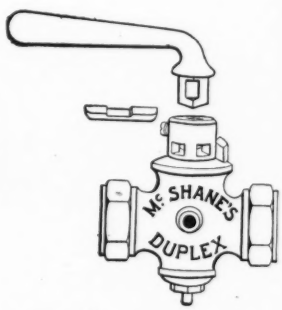
Earthenware Specialties designed and finished with unsurpassed art and workmanship.

The Sanitary Earthenware Specialty Company

Trenton, N. J.

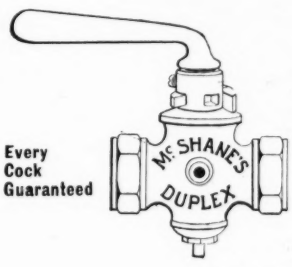
THE

"Duplex" Stop Cock



One of Simplest Cocks on the Market To-day

The above shows how easily the Cock can be taken apart and made either Right or Left hand as desired.



Every Cock Guaranteed

They are made of best metal and thoroughly ground

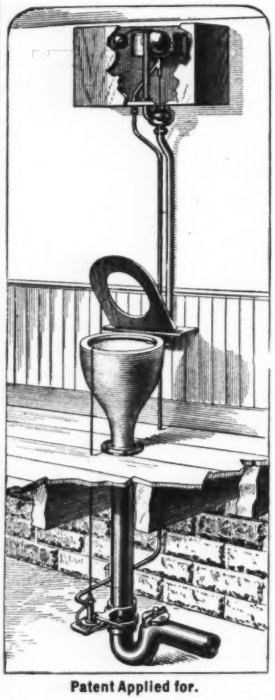
Each Cock is tested before leaving the factory

Manufactured only by

Henry McShane Mfg. Co.

BALTIMORE, MD.

A 12 TRUMP HAND
IN WHIST
IS NOT AS SURE OF
Anticipated Results
AS
TWELVE ADVERTISEMENTS
FROM A RELIABLE, PROGRESSIVE FIRM
IN
DOMESTIC ENGINEERING
MONTHLY EDITION.
YOU ARE SURE TO MAKE TWELVE POINTS IN THE YEAR, AND YOUR "AD" IS BACKED BY THE DIGNITY AND HONEST PURPOSE THAT PERVADES THESE PAGES.
SEND FOR RATES



The Walls & Pearsall

Anti-Freezing Closet

For Outside Locations

Can be used where other closets would freeze. Perfectly frost proof in zero weather.

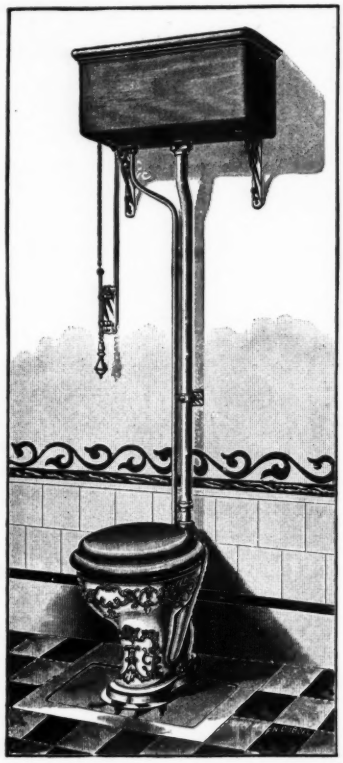
The tank contains no ball or cock washers, has no chain or pull, is simple in construction, cheap and durable. No water above frost line. An automatic flush after each using.

A small quantity of water is discharged before each using, in order to keep Hopper damp and prevent any substance adhering.

Patent Applied for.

WALLS & PEARSALL

305-307 N. Twelfth St. PHILADELPHIA, PA.



"Defender"

Siphon Jet Water Closet

EQUAL TO ANY SIPHON JET CLOSET IN THE MARKET.

Complete line of tanks, seats and earthenware, also McClellan Anti-Siphon Trap Vent.

F. N. DuBois & Company, 243-247 Ninth Ave.

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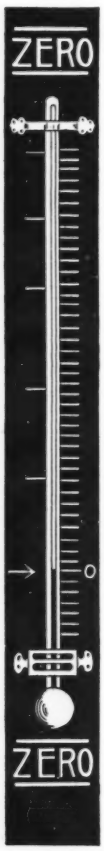

Zero Quick Wasting Hydrant,
Zero Jr. Hydrant,
Zero Self-Closing Hydrant.

Large Wastes, Quick Action, Non-Freezing. Cheapest and best Hydrants in the world.

Zero Brass & Valve Mfg. Co.

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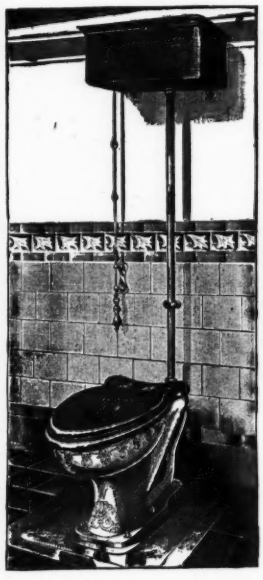


—THE—

ORINOCO

Syphon Jet Closet.

This Orinoco Syphon Jet Closet is what you should have. This is the most perfect and noiseless closet now manufactured. The workmanship and High Grade Finish of the Orinoco Closet cannot be excelled.

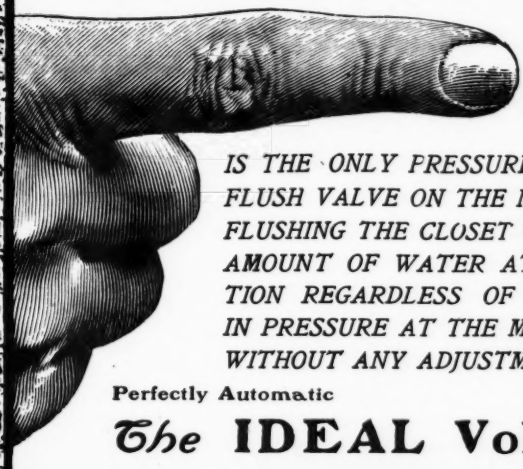
IT SPEAKS FOR ITSELF
TRY ONE AND BE CONVINCED.

MANUFACTURED BY

THE KING MFG. CO.

LIMITED.

205 Wood Street, Pittsburgh, Pa.

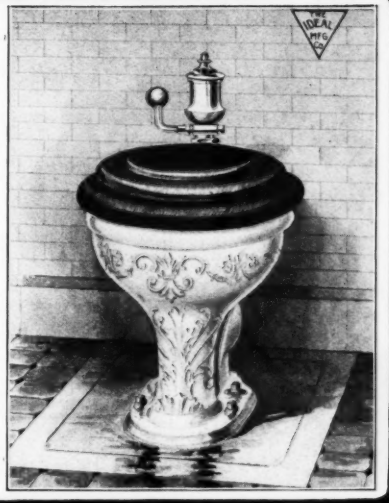


THAT

IS THE ONLY PRESSURE REGULATING FLUSH VALVE ON THE MARKET. FLUSHING THE CLOSET WITH THE SAME AMOUNT OF WATER AT EACH OPERATION REGARDLESS OF FLUCTUATIONS IN PRESSURE AT THE MAIN OR SUPPLY WITHOUT ANY ADJUSTMENTS.

Perfectly Automatic Patented

The IDEAL Volumeter



THE IDEAL MFG. CO. DETROIT MICH.

The IDEAL Mfg. Co.

Manufacturers of

Fine Sanitary Specialties

DETROIT MICH.

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THE IDEAL MFG. CO. DETROIT MICH.

The

"Sedate"

We Handle all grades of Low Down Tank outfits, including syphon jet, syphoning hoppers with jets and plain hopper and trap combinations.

We Manufacture the "QUIET" syphon jet and the "SEDATE" syphoning hopper outfits and recommend them to all who desire a thoroughly high grade and highly perfected outfit.

The TANKS, seats and lids are made from carefully selected hard woods, which are highly finished. The "Quiet" and "Sedate" tanks have heavy tinned copper linings and all seams are locked and carefully soldered.

Haines, Jones & Cadbury Company

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For Nineteen Hundred and One

Our Jobbers' and Manufacturers' Directory for 1901 is now being printed and will be ready for delivery early in January. Orders will now be received.

Price, Delivered $5.00

The book will be more usable than ever before, as the jobbers of plumbing material are listed separately from those handling heating and mill supplies.

Domestic Engineering
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STANDARD BATHS

We believe every plumber and dealer should carefully consider the trade-winning qualities of the line of enameled goods which he carries.

The product of the four leading concerns, composing this company has the reputation of being the best in the world.

These four concerns are:

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The Ahrens & Ott Company, Louisville.
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The high reputation for beauty and durability which these goods have gained has created a strong and permanent demand for them the world over.

The best line of goods for the dealer to handle is that for which there is the greatest demand.

Free catalogues may be obtained at the home office or any of our branch houses.

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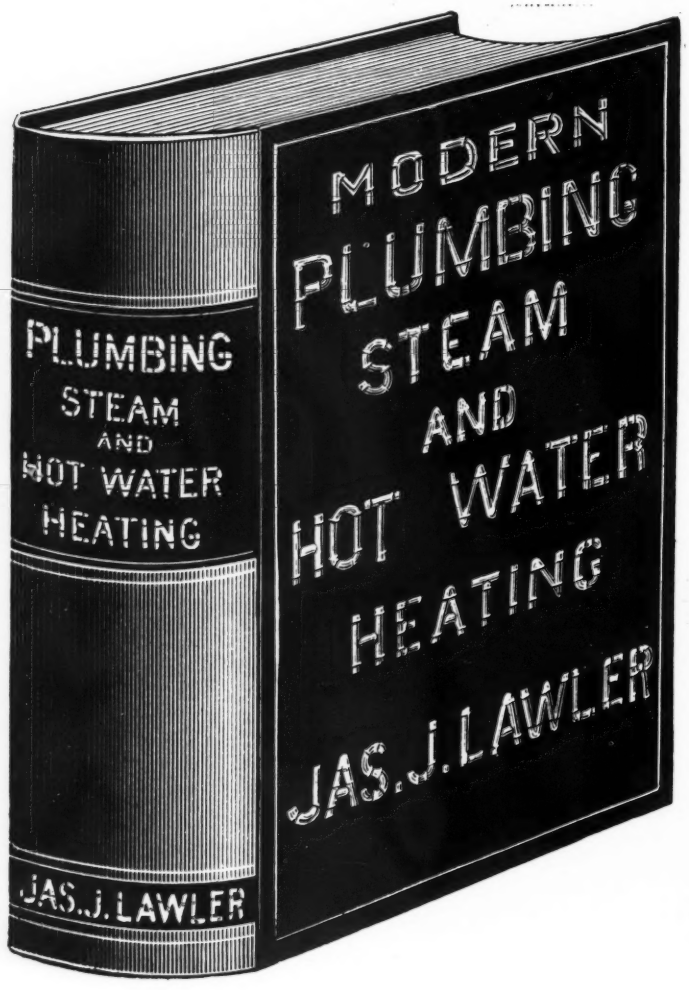
CHARLES AUSTIN BATES N Y

LATEST AND BEST



In Plumbing

It explains soil and waste pipe ventilation, back venting, the house trap, the fresh air inlet and their advantages. Siphonage of traps, the cause and how to remedy the same. How to test soil and waste pipes. Probable questions of plumbing examining boards, and answers to same. Hydraulics of plumbing, with original illustrations. Practical drawings and all important features in the construction of modern plumbing work.

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It tells how to correctly figure on any size or shape of building with steam or hot water. How to find the heating capacity of any shape or make of boiler for steam or hot water heating. The most practical timesaving tables ever compiled and published. A new table of how to quickly find the correct measurement of 45° angles, a most useful thing in steam and hot water construction. This has never before appeared in print.

More practical illustrations than ever published in any one volume, which shows the various systems of construction, in the heating and ventilating of buildings by the steam or hot water systems.

Over three hundred diagrams and illustrations, showing the various systems of construction in the heating and ventilating by steam or hot water systems. Six folding inserts showing waste pipe system of plumbing, one pipe system of both steam and hot water heating, overhead system, fan system of heating and ventilation, and steam and hot water circuits. 400 pages, large octavo size, 10x7½ inches. Bound in extra cloth.

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THE "GEGENSTROM"
HOT WATER APPARATUS

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FOR THE INSTANTANEOUS
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WARM OR HOT WATER

BY MEANS OF STEAM.

ESPECIALLY ADAPTED FOR

RAIN BATHS

IN INSTITUTIONS,
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AND PRISONS,
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INSANE ASYLUMS,
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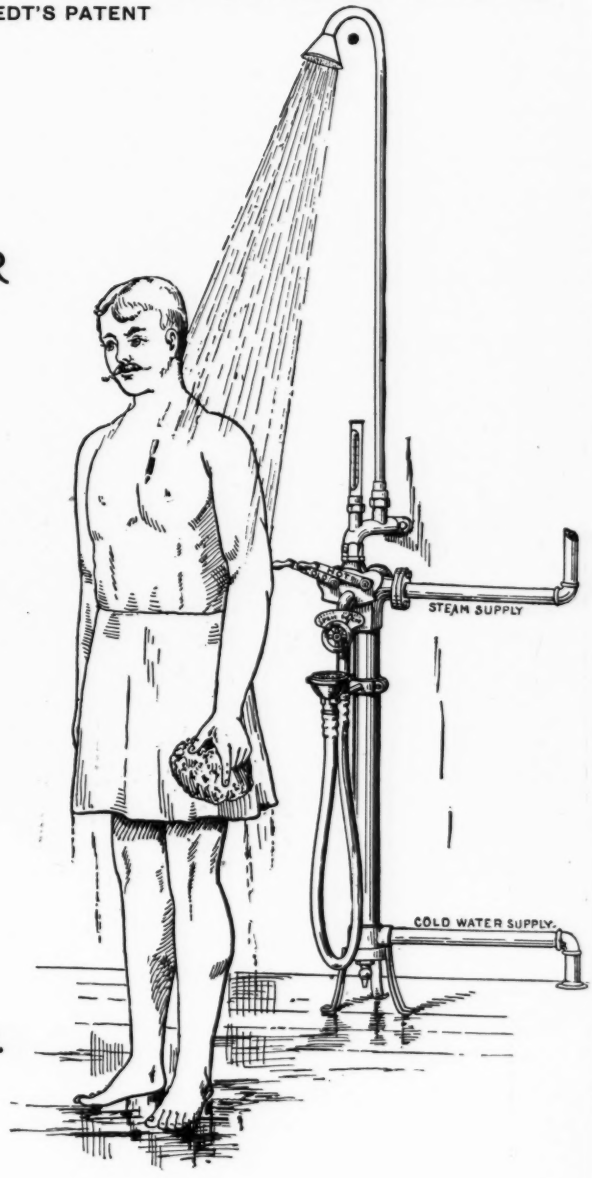
AND IN
PEOPLE'S BATH ESTABLISHMENTS.



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Trenton Potteries Co., Trenton, N. J.

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You can get along with cheap and inferior plumbing supplies.

You can use stop and waste cocks that leak, fuller work which hammers and rattles, and compression bibbs with defective seats that constantly leak and drip.

You can do this, but why should you?

Why not use the best which costs no more than the next best, but which pays you better.

Glauber supplies are just as well made as we know how to make them.

Glauber stop and waste cocks do not leak.

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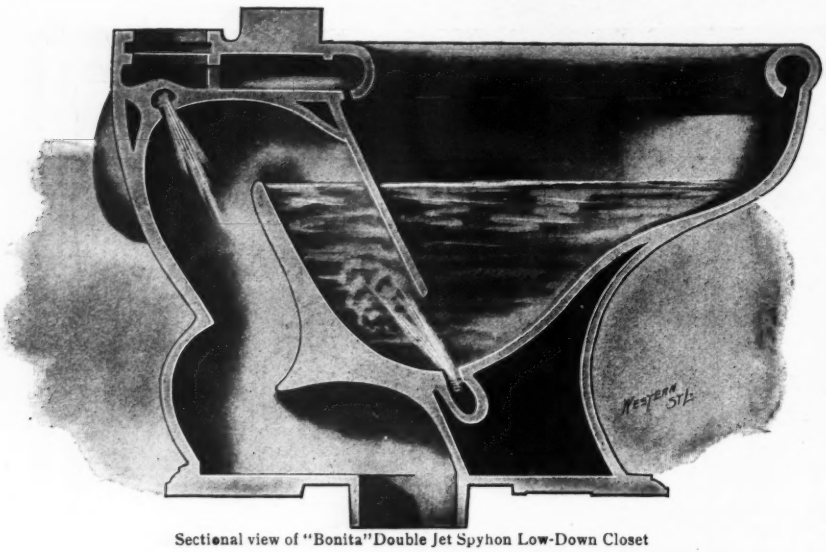
Glauber compression bibbs are perfect.

Our complete catalogue shows designs. Send for it and don't lose another day before giving the Glauber goods a fair trial.

GLAUBER BRASS MANUFACTURING CO., CLEVELAND, OHIO



Sectional view of "Bonita" Double Jet Syphon Low-Down Closet

Rumsey's "Bonita"

Double Jet Low-Down Syphon Closet

The cut at the top of this page shows a sectional view of our "Bonita" closet, as designed and patented, for low-down use. The objections heretofore in low-down closets have been the inefficiency of the syphoning, because of the lack of pressure, caused by placing the tank so near the closet. The difficulty is overcome in our new closet by adding a downward jet into the discharge leg of the closet, thus driving the air out of the discharge leg of the closet and removing the resistance to the upward jet. The downward jet is effectively trapped to prevent gases passing through same and through the flushing rim into the room.

We recommend this closet to architects and plumbers as a perfect working and sanitary closet.

L. M. Rumsey Mfg. Co.

810 North Second St. ST. LOUIS, MO.

Rumsey's "Bonita" Double Jet Syphon Low-Down Closet with Porcelain Tank

SUPPLIES AND TOOLS FOR Plumbers GAS & STEAM Fitters.

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"Repeat it to yourself,
write it down,
do not forget,
but remember,
remember,
remember that advertising is
the news of business,
that good advertising is good
news,
that good news finds listening
ears."

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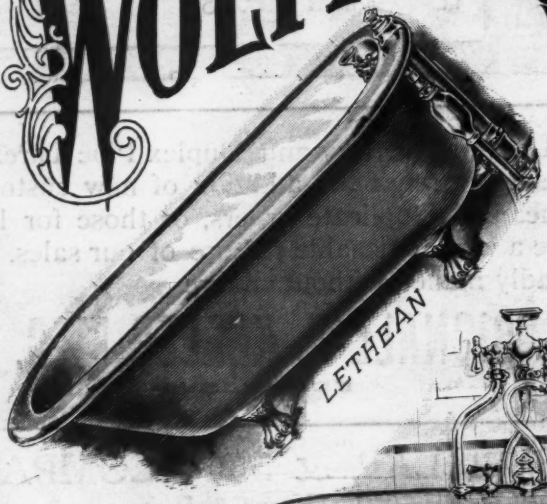

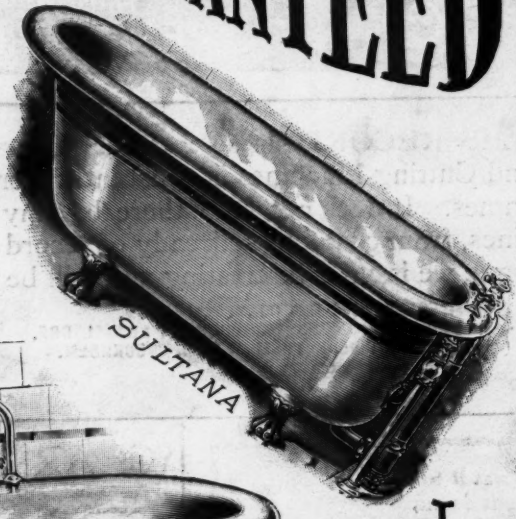

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